DISCLAIMER:

This document does not meet the
current format guidelines of
the Graduate School at
The University of Texas at Austin.

It has been published for
informational use only.

Copyright

by

Gwen Marie Platt

2013

The Dissertation Committee for Gwen Marie Platt Certifies that this is the approved version of the following dissertation:

Exploring Culturally Responsive Mathematics Instruction with Latino/a Learners in Elementary Classrooms

Committee:

Audrey Sorrells, Supervisor

Shernaz Garcia,

Diane Bryant

Sylvia Thompson

Cinthia Salinas

Exploring Culturally Responsive Mathematics Instruction with Latino/a Learners in Elementary Classrooms

by

Gwen Marie Platt, B. Music, M. S. Ed.

Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

The University of Texas at Austin

December 2013

Exploring Culturally Responsive Mathematics Instruction with Latino/a Learners in Elementary Classrooms

Gwen Marie Platt, Ph.D.

Supervisor: Audrey M. Sorrells

Schools are, to a large degree, failing to teach mathematics to large numbers of culturally, linguistically, and socioeconomically diverse (CLSD) students. Two factors that support this assertion are the low achievement and high dropout rates of many CLSD students. Latino students, in particular, score among the lowest of all student groups and have the highest dropout rates. Research indicates that culturally responsive teaching (CRT) is a promising approach to improving achievement. CRT teaches to and through the rich cultural heritage that CLSD students bring to the classroom. There have been very few studies of CRT with Latino students who are typically viewed as being at educational risk. The purpose of this study is to describe how successful upper elementary teachers teach mathematics to Latino students with and without disabilities. The research questions guiding this inquiry were: (1) What are the features of math instruction utilized by successful elementary math teachers of Latino/a students typically viewed as being at educational risk? (2) How are these features responsive to students' cultural and linguistic backgrounds and personal life experiences? (3) How do their instructional practices with Latino/a students correspond with the theoretical principles of culturally responsive teaching? This study employed a multiple case study design (Stake, 1995) with the mathematics classroom making up the bounded system. Five teachers and their students served as embedded units of analysis who were instrumental in understanding culturally responsive teaching. Data were collected through observation, guided semi-structured interviews and field notes about participating teachers instruction. Data analysis consisted of constant comparison and by noting patterns and themes, arriving at comparisons and contrasts, and determining conceptual explanations for the

data. Results revealed that teachers used a wide variety of teaching methods including reviewing previously learned concepts, making instruction relevant, making instruction comprehensible, and teaching through music, rhymes, movement, and visuals. Findings revealed that there was very little evidence that teachers overtly planned activities that directly addressed culture. Implications for future research and teacher preparation programs are discussed.

Table of Contents

List of Tables

List of Figures

CHAPTER I

My interest in culture began several years ago when I moved from a predominantly homogeneous White middle class area of the Pacific Northwest to deep South Texas, a predominantly homogeneous Mexican American area. I had very little experience with people who were different from me in culture and language. I had been teaching for about 11 years as a music, kindergarten, and special education teacher. I was employed as a music teacher as my first job in South Texas then later as a special education teacher. My students were predominantly Mexican American as were my colleagues and supervisors. I cannot begin to describe my experience with "culture shock." At one point I was so confused and frustrated with the behavior of my colleagues and supervisors (they did nothing wrong; just different) that I stood in the middle of our living room crying with the phone in my hand asking my husband if he thought I should call my principal and resign. Fortunately I persevered, and with time, the frustration decreased dramatically.

Because of my experience with culture shock, I began to realize the importance of culture in relationships between people. In particular, I began to understand the difficulty that many students from culturally, linguistically, and socioeconomically diverse (CLSD[1]) communities encounter in U. S. schools. I cannot imagine being a young student sitting in a classroom trying to learn and experiencing the confusion I experienced. Through this experience, I was led to the University of Texas at Austin to pursue a doctorate in multicultural special education. Through my class work there I was introduced to culturally responsive teaching. I have come to believe that culturally responsive teaching is critical to reduce the discontinuity (culture shock) that often occurs between the White middle-class culture of most teachers and the cultures of many

[1] [1]Students from CLSD backgrounds include Latino/a, African American, American Indian/Alaska Native, Asian/Pacific Islander, and poor students of all racial/ethnic backgrounds.

students from CLSD backgrounds. Reducing discontinuity between schooling and students from CLSD backgrounds is essential to assist students in forming a positive identity and to engender psychological well-being as well as to facilitate academic achievement (Pollock, 2008; Valenzuela, 1999). However, in readings and classroom discussions about culturally responsive teaching at the University of Texas at Austin, it became evident that very little is known about how teachers might implement culturally responsive teaching in any area but this is especially true in the area of mathematics. Therefore, this research study is about implementation of culturally responsive teaching in mathematics. It is my purpose to do what I can to assist teachers in learning to adjust their teaching to make schooling a more equitable place for students from CLSD backgrounds.

Although underachievement in mathematics is a continuing problem in U. S. public schools for many groups of students, Latino/a[2] students are the focus of this research because they are the largest group of ethnic and language minority students in the U. S., have some of the lowest achievement rates in mathematics of all student groups, and are considered to be at educational risk (National Center for Education Statistics [NCES], 2009a). One of the factors contributing to this underachievement offered in the literature is the cultural discontinuity between teachers from monolingual English, White, middle-class backgrounds and many of the students from CLSD backgrounds they teach (Gay, 2000, 2002, 2009; Guiberson, 2009; Hollins, 2008; Ladson-Billings, 1996). Cultural discontinuity may lead to a deep chasm developing between students and teachers that may negatively affect student motivation, engagement with the school, and ultimately achievement (Cartledge & Kourea, 2008; Delpit, 1995; Gay, 2000, 2002, 2009). To prevent this from happening, teachers need tools to bridge

[2] I utilize "Latino/a" as an umbrella term to refer to a diverse group of people who originate from diverse countries and regions where the Spanish, typically through colonization, strongly influenced the culture and language. These countries include Mexico, Puerto Rico, Cuba, Central and South American countries, and regions of the U.S.

socio-cultural and linguistic differences between the White middle-class institution of schooling and students from CLSD backgrounds.

Culturally responsive teaching (CRT) is recognized in the literature on effective schooling for students from CLSD backgrounds as being a powerful tool in the hands of teachers to address discontinuity and thereby improve mathematics outcomes for students from CLSD backgrounds (Lipka, Sharp, Adams, & Sharp, 2007; Webster & Yanez, 2005). Gay (2000) defines culturally responsive teaching as "using the cultural knowledge, prior experiences, and performance styles, of diverse students to make learning more appropriate and effective for them; it teaches to and through the strengths of these students" (p. 29).

STUDENT DEMOGRAPHICS AND PATTERNS OF UNDERACHIEVEMENT

Student Demographics

Current demographic estimates indicate that Latino/a students make up 22% of all students in the U.S. and thus are the nation's largest group of students from CLSD backgrounds (National Center for Education Statistics [NCES], 2010a). Further, the number of Latino/a students enrolling in U.S. schools is growing at a more accelerated pace than other groups of students. For example, between 1998 and 2008, the enrollment of Asian/Pacific Islander students increased from 4% to 5%, American Indian/Alaska Native students increased from 1.1% to 1.2%, Black[3] students stayed the same at 17%, and White students actually decreased from 63% to 55%. However, during this same time period, the enrollment of Latino/a students increased from 15% to 22%. (NCES, 2010a). By 2035, one third of all U.S. children and youth will be Latino/a (Population Reference Bureau [PRB,] 2010). Today's 16 million Latino/a children and youth (PRB, 2010) thus represent a crucial segment of the nation's students, future workers, taxpayers, parents, citizens, voters, and leaders.

[3] Although the term "African American" is generally used in this paper to refer to a group of people with ethnic origins from the continent of Africa, I use "Black" to refer to this same group of people when the source material, usually government reports, uses this term.

Although stigmatizing labels for any person or group of people are undesirable, student groups who come from families who are poor or working class, who drop out of school in higher numbers, speak a language other than English at home, perform below grade level, and come from ethnically and culturally diverse backgrounds are frequently labeled at-risk for academic failure by the U.S. school system (Cuban, 1989). From this perspective, a majority of Latino/a students meet the description for "at-risk" students (Brewster & Bowen, 2004; Fletcher & Navarrete, 2003; Hassinger & Plourde, 2005). "At-risk" is an unfortunate and inaccurate label because it locates learning difficulties within the child or group of children rather than more accurately locating responsibility for learning difficulties on the interaction between students from CLSD backgrounds and the U. S. school system (Johnson, 1994). Therefore, rather than using the term "at-risk students," the phrase "students in at risk settings" or "students perceived to be at risk" is used throughout this study to indicate that as a group, these students deserve enhanced educational attention, but that the primary focus for addressing their learning problems should be on the interaction between the school environment and student characteristics rather than solely on the student and his or her family (Adelman, 1992; García, Wilkinson, & Ortiz, 1995; Johnson, 1994).

Patterns of Underachievement

Patterns of underachievement for Latino/a students can be seen in the following "gaps" that occur between Latino/a students and mainstream White middle class students. Hispanic[4] students are not only nearly four times more likely to drop out of school than White students but have the highest dropout rate of any group of students (NCES 2010b). A wide achievement gap has existed historically in mathematics between Latino/a students and their white middle class peers, and continues to plague educators and students. For example, the Nation's Report Card (NCES, 2009a) indicates that in fourth grade, 29% of Hispanic students scored below basic in mathematics compared to 9% of

[4] I utilize the term Hispanic to refer to the same group of people as Latino where the source material uses the term Hispanic, usually in government reports.

White students. In eighth grade, 43 % of Hispanic students scored below basic compared to 17% of White students. More than two thirds (71%) of English Language Learners, the largest percentage of whom are Hispanic, scored below basic in mathematics. In fourth grade only 1% of Hispanic students scored at the advanced level in mathematics compared to 8% of white students (Guiberson, 2009; Guiterrez, 2004; NCES, 2009a). These achievement gaps indicate that Latino/a students are about two grade levels below white students in mathematics (Sparks, 2011). See table 1.1 for a comparison of math achievement between White and Latino/a students at grades four and eight.

Although all of the above gaps are cause for deep concern, the achievement gap in mathematics is particularly urgent due to evidence that mathematics competence accounts for variance in employment, income, and work productivity even after intelligence and reading have been explained (Rivera-Batiz, 1992). Deverics (2009) noted that math achievement often best predicts future college success.

Why aren't Latino/a students achieving better in mathematics? Contrary to persistent myth, it is not that Latino/a students as a group lack interest in math nor is it due to lack of high aspirations, lack of effort, lack of ability, or lack of capable, caring parents (Civil & Bernner, 2006; Cuban, 1989; Gay, 2009; Ladson-Billings, 1994, 2006; Valencia, 1997; Valenzuela, 1999).

Table 1.1: Level of Math Achievement for Hispanic and White Students in Grades Four and Eight (2009)

	4th Grade		8th Grade	
	Hispanic	White	Hispanic	White
Below basic[1]	29	9	43	17
At basic	49	40	40	40
At or above proficient	22	51	17	44

At advanced	1	8	2	11

Note. All figures from: NCES, 2009a

[1]"Basic" denotes partial mastery of knowledge and skills that are fundamental for proficient work at a given grade. Below basic, therefore, denotes less than this level of achievement.

Therefore, it is inappropriate to solely blame students or parents for lack of student achievement in mathematics. In fact, several studies document that African American and Latino/a students sometimes have more positive attitudes toward mathematics and higher educational aspirations than do their White counterparts, especially in the early years of secondary school (Goldsmith, 2004; Strutchens & Silver, 2000). Rather, scholars have held that responsibility for student learning should be placed on the interaction between the school system and student characteristics rather than solely on students from CLSD backgrounds and their families
(Adelman, 1992; García, Wilkinson, & Ortiz, 1995; Johnson, 1994).

EDUCATIONAL AND POLICY RESPONSES TO UNDERACHIEVEMENT

Efforts to Enhance Student Achievement

***School reform efforts*.** Over the years, governmental and educational institutions have put forth efforts to close achievement gaps. Governmental reforms since the 1960's to close achievement gaps include large scale projects such as President Lyndon Johnson's "War on Poverty," which sought to ameliorate the deleterious effects of poverty on student achievement; the Economic Opportunity Act (1964) which established the Head Start program; and the Elementary and Secondary Education Act (1965) which created Title 1 programs. More recently, the No Child Left Behind Act of 2001 (No Child Left Behind Act, 2001) requires schools to report achievement results separate for various poverty, ethnic, language, and disability subgroups. If achievement gaps are identified in these different groups, schools must take specific steps to close them (Guskey, 2007). Educational efforts to close achievement gaps have included pedagogical reforms over the years such as Direct Instruction, Instructional Theory Into Practice, Mastery Learning, Cooperative Learning, Constructivism, Standards Based

Instruction, and more recently, Response to Intervention, to name a few. However, notwithstanding these long-term and on-going efforts, the achievement gap in mathematics and other areas of the curriculum remains firmly entrenched (Sparks, 2011; Devarics, 2009; Ladson-Billings, 2006; NCES, 2009a).

Current reform through Response to Intervention (RTI). Related to underachievement of students from CLSD backgrounds is the disproportionate representation of students from CLSD backgrounds in special education. Some groups of students from CLSD backgrounds such as African Americans and in some states, districts, and disability categories Latino and Native American students, are overrepresented in special education. Others, such as some Asian groups are underrepresented (Donovan & Cross, 2002). Artiles, Rueda, Salazar, and Higareda (2002) found that English-language learners (ELL's) were underidentified in the LD category in the early grades, but overidentified beginning in fifth grade.

For many years a discrepancy or "wait to fail" model of identification of students with disabilities was utilized. In this model, struggling students spent years of failure before a sufficient discrepancy between academic ability and achievement developed that would qualify them for special education services. With this model, many students from CLSD backgrounds were either overidentified, misidentified, or underidentified for special education services. (Kashi, 2008; Skiba, et al., 2008). Due to these difficulties with the discrepancy model, a provision was added to IDEIA (2004) which allowed states to move toward a response to intervention (RTI) model for eligibility determination.

Response to intervention can be described as "the degree to which a student who has been identified as at risk for academic or behavioral problems and has been provided with intervention has benefited from the intervention and eliminated or considerably reduced his or her risk status" (Linan-Thompson, Vaughn, Prater, & Cirino, 2006, p. 390). According to D. Fuchs and L. S. Fuchs (2004), within the RTI model, students are identified with learning disabilities "when their response to generally effective instruction

(i.e., instruction to which most children respond) is dramatically inferior to that of their peers" (p. 216). Students who make expected gains are said to respond to instruction, and they are expected to continue to make progress when adequate instruction is provided in the general education classroom. Students who make small or insufficient gains with high quality instruction are described as not adequately responding to intervention (Linan-Thompson et al.). A current model that has received the most attention in the literature on RTI has three "tiers." The first tier involves quality, evidence based instruction for all students in the general education classroom. In the second tier, children who do not reach expected bench marks are then taught in either small groups or individually with more intensive instruction which may mean more time and/or more individualized materials. The third tier is reserved for those few students who do not make adequate progress even with more intense instruction. It is often at the third tier where special education may be involved.

Cultural responsiveness in RTI. Response to intervention emphasizes proactive high quality evidence-based instruction in tier one, or the general education classroom, as a preventative to learning problems. The goal of RTI is to prevent academic difficulties for students whose difficulties stem from inappropriate curriculum and/or instruction. Response to intervention recognizes the role that classroom curriculum and pedagogy play in student achievement. Response to intervention has the potential to affect change for CLSD students by requiring evidence-based practices based on individual needs. However all classroom practices must consider a student's cultural background experiences as well as their linguistic proficiency in order to be appropriate. Otherwise, RTI may become just one more discriminatory system. To help ensure that RTI does not become a discriminatory system, educational practices and programs need to be evidence based and validated with the students from CLSD backgrounds that it purports to benefit (L. S. Fuchs & Vaughn, 2006; Linan-Thompson, Vaughn, Prater, Cirino, 2006; Wilkinson et al., 2006). However, scientifically-based research on minority students, the very students RTI purports to benefit, is often not available. (García & Ortiz, 2004;

Harris-Murri, King, & Rostenberg, 2006; Klinger & Edwards, 2006; Ortiz, Wilkinson, Robertson-Courtney, & Kushner, 2006). Furthermore, much of the research on effective tier one instruction focuses on reading instruction, relatively little empirical research has focused on effective strategies for teaching mathematics. Importantly, the potential for underachievement and inappropriate eligibility decisions are still present if RTI instructional techniques are not culturally responsive (Harris-Murri et al.). Unless response to intervention strategies are culturally responsive, they may add to the culture chasm between Euro-centric pedagogy and curriculum and students from CLSD backgrounds.

CULTURE CHASM

With the limited success of past programs and pedagogy in improving the mathematics achievement of Latino/a and other students from CLSD backgrounds, multicultural education scholars (Banks & Banks, 2007; Gay; 2009; Ladson-Billings, 2006; Sleeter & Grant, 2007) have long held that there is another type of educational gap worthy of concern. That is, the culture gap that occurs between mostly White Euro-centric teachers and their minority[5] students. Currently nearly 45% of U.S. students are from CLSD backgrounds while about 86% of all elementary and secondary teachers are White (NCES 2010c). Teachers are also generally female and middle-class and have an average income of $53,000 compared to $38,000 for Hispanic families and $32,000 for Black families (U.S. Census Bureau, 2009).

Subsumed within the larger culture gap are other related gaps. For instance, the gap between Euro-centric curriculum and instruction and the knowledge and ways of knowing of students from CLSD backgrounds (Apple, 1996; 2004; Beyer & Liston, 1996) and the gap between the mathematics that dominates most U.S. classrooms and the

[5]The term "minority students" is used interchangeably with the term "students from CLSD backgrounds." "Minority" denotes a social status and does not necessarily include smaller numbers. There are, for example, neighborhoods and schools where "minority" students are the numerical majority. However, the term "minority" carries with it the comparative lack of power within the U. S. society that ethnically, racially, culturally, and socio-economically diverse groups of people endure.

formal and informal mathematics that students from CLSD backgrounds may bring to school with them (Greer, Mukhopadhyay, Powell, & Nelson-Barber, 2009). In light of teacher and student demographics and the nature of culture, the culture gap between the mainly White middle-class teaching force and Latino/a students could be defined as a "culture chasm." Several factors that influence the lack of achievement of minority students in mathematics and other areas of the curriculum have been identified in the literature. Among them are institutional bias (Bordeau & Passeron, 1977) poorly funded schools (Biddle & Berliner, 2002; Brown, 2007; Kozol, 1991) power and privilege of the dominant group (Apple, 1996) poorly qualified teachers (Coleman, et al. 1966), and deficit thinking (Cuban, 1989; Valencia, 1999). My conception of a culture chasm subsumes all these factors as they are inherently reflections of the divide between the dominant Euro-centric middle-class institution of schooling and students from CLSD backgrounds. Even non-mainstream teachers of color can contribute to the culture chasm due to the fact that their teacher education programs are based on the monocultural Euro-centric middle-class culture (García & Guerra, 2004). In the literature on effective schooling for minority students, *culture chasm* is usually referred to as "lack of cultural congruence" (Mohatt and Erickson, 1981; Nieto & Bode, 2008), "cultural discontinuity" (Gay 2000, 2002, 2009), or simply, "culture clash" (Chamberlain, 1999). I will these terms interchangeably in this paper.

I view the reconceptualization of "culture gap" as "culture chasm" as helpful in depicting the *deep* and *wide* differences that occur between the Euro-centric middle class institution of schooling and minority students. It is also helpful in preventing the superficial conceptualization of culture as simply food, holidays, music, and other surface level manifestations of culture. The dimensions of deep and wide refer to the systemic nature of culture in that, in the U.S., the dominant Euro-centric middle-class culture is pervasive throughout layers of government, state and national policy and legislation, educational research and leadership, teacher education institutions, the entire hierarchy of school administration, as well as classrooms and all other educational support systems

(Beyer & Liston, 1996; Bordieu, & Passeron, 1977; Delpit, 1995; King 2005; Skiba, et al. 2008). Students from CLSD backgrounds too have a culture that is deep and pervasive throughout their experience, but may be very different from the U.S. mainstream culture. The challenge for educators is in building a bridge to span the chasm between the culture of the U.S. school system and the cultures of minority students so that two-way communication and reciprocal sharing of mathematical knowledge can occur. Teachers bring mainstream mathematics to the students, but students also have opportunity to bring their cultural mathematical knowledge to the classroom.

When a bridge is built over a physical chasm, it is constructed using tools that are specific to doing a certain aspect of the bridge building. For example, a welder is needed to combine pieces of steel together, a crane is needed to lift heavy sections of the bridge and fit them together, excavation tools are needed prepare the site for building, and so forth. If bridge builders don't have the proper tools, the bridge is not likely to be built well or built at all. So in educating students from CLSD backgrounds, teachers need proper tools specific to the task of building a bridge between the cultures of minority students to the mainstream culture of U.S. schools. Culturally responsive mathematics instruction has been put forth in the literature on effective schooling for students from CLSD backgrounds as one of these "tools" in building a bridge between the Euro-centric school system and minority students. Other educational tools are also needed such as equitable school funding, high quality multicultural teacher preparation programs, anti-discrimination policies and practices, and bilingual or dual language programs. Nevertheless, the literature on effective mathematics instruction for students from CLSD backgrounds indicates that culturally responsive teaching is a necessary "tool" for making teaching more effective for minority students (Barta & Brenner, 2009; Brenner, 1998; D'Ambrosio, 2009; Gay, 2000, 2009; Gutstein, 2006; Ladson-Billings, 1995, 2006; Lipka, 1994; Lipka, Yanez, Andrew-Ihrke, & Adam, 2009; Moschkovich & Nelson-Barber, 2009; Moses, West, & Davis, 2009) However, in spite of a growing interest in culturally responsive teaching in mathematics, few teachers implement culturally

responsive instruction in mathematics or are prepared for this task. This lack of implementation of culturally responsive teaching in mathematics then is of great concern to researchers and educators who are aware of the nature of culture, and the impact that culture has on the teaching and learning process.

THE NATURE OF CULTURE AND THE IMPACT ON TEACHING AND LEARNING

The nature of culture. Culture can be described as " the ways in which a group of people make meaning of their experiences through language, beliefs, social practices, and the use and creation of material objects" (Gutstein, et al., 1997, p. 711). Saravia-Shore and Arvizu (1992) describe the function of culture as guiding "people in their thinking, feeling, and acting" (p. xxvii). Gloria Ladson-Billings (1997) states that "culture refers to the deep structures of knowing, understanding, acting, and being in the world and cannot be suspended as human beings interact with subject matters or domains of learning" (p. 700). According to Crotty (1998) “culture is best seen as the *source* rather than the *result* of human thought and behavior” (p. 53; emphasis added). Some significant aspects of culture are that culture is invisible to the members of that culture, is shared through *habitus*, and that members of a culture generally believe their cultural values apply universally to everyone.

Culture for any group of people developed over many centuries as a result of how the group successfully interacted with and adjusted to environmental factors. Because certain patterns of thought and behavior were effective for the group as a whole, they were constantly reiterated and became the “default” or automatic way that people lived, thought, and behaved. Everyone within the culture thinks and behaves in essentially familiar ways. Bordieu and Passeron (1977) argue that both people and the institutions within a culture possess habitus, or dispositions and actions that are shared and learned through activities and experiences of everyday life. Geertz (1973) asserts that members of cultures go about their daily lives within shared webs of meaning

Culture is so much a part of each of us and the group(s) we live with that our culture becomes invisible to us as well as the other members of our culture (Banks & Banks, 2007). Because culture is deeply ingrained and usually invisible to the members of the culture, culturally based values, beliefs, learning styles and attributions for behavior become assumptions that are thought to apply equally to everyone regardless of the fact that the other person may be from a different cultural or ethnic background and thus have a different set of beliefs, values, patterns of thinking, learning style, knowledge, and attributions for behavior etc. The assumption that the same culturally based set of values apply to everyone is often called *universalism* (Gareis, 2005; Hollins, 2008; McFarland, 2011). In the U. S., the White middle class cultural assumptions are presumed to be the universal or "normal" ways of being

Impact on teaching and learning. In classrooms where teachers—regardless of their own race and ethnicity—are representative of monocultural, Euro-centric, middle-class curriculum and pedagogy, and students are from CLSD backgrounds, students and teachers each have their own cultural value orientations that are invisible, universal, or the "normal" way of being that may differ from one another. As a result, intercultural interactions in the classroom may contribute to much misunderstanding, confusion, frustration, hurt feelings, anger, loss of identity and loss of self-esteem. This is the essence of "culture chasm" at the classroom level and is a major factor in the lack of achievement of Latino/a and other students from CLSD backgrounds (Gay, 2000). Although negative feelings in this situation can be experienced by both teachers and students in the diverse classroom, they are especially unfortunate for students because the student is in the minority and has very little power in the schooling situation to alter his or her circumstances. In the case of some students, loss of self-esteem may become so devastating that the student identifies him or herself as the problem and negative identity and feelings of helplessness may develop resulting in psychological problems such as depression (Suárez-Orozco, C., Suárez-Orozco, M. & Doucet, 2004; Valenzuela, 1999, 2008). For instance, Emslie, Weinberg, Rush & Adams (1990) and Wight, Aneshensel,

Botticello, & Sepulveda (2005) state that Latino/a students have the highest incidence of depression relative to any other ethnic group of students. Similarly, the teacher too may feel helpless and unprepared by his or her teacher preparation programs to meet the needs of students from diverse backgrounds. Such limited or lack of preparation has been associated with a tendency to engage in *deficit thinking* and to apply traditional approaches to mathematics instruction, both of which may limit the success of students from CLSD backgrounds.

Deficit thinking about student diversity. Geneva Gay (2000) states that conventional paradigms and proposals for improving the achievement of culturally, linguistically, and socioeconomically diverse students are doomed to failure largely due to the deficit thinking that pervades educational institutions. Deficit thinking places the responsibility for failure on students and their families rather than on the institution of schooling (Valencia, 1997). Educators from a deficit orientation concentrate on what ethnically, racially, linguistically diverse and low income students don't have and can't do. These ideas are so ingrained in European American culture and thought that they are rarely closely examined and are part of the basic assumptions many educators bring to teaching. Deficit beliefs may be expressed in attributions for behavior similar to these: The child is not turning in homework, therefore he or she is lazy and his or her parents do not care enough about education to assist the child with homework. The student seems to be either angry or withdrawn therefore he or she is referred to special education for a behavior problem. The child does not look directly at the teacher when he or she is speaking to the student therefore the student is thought to be disrespectful. Students' speech overlaps in the classroom therefore they have not been taught proper manners for speaking in social situations. Though the problems mentioned here could have an individual basis; these same "problems" could very likely be expressions of typical behavior in the students' home culture or be a reaction to being misunderstood in school. Therefore, it is important not to automatically assume the problem lies within the child.

From an ecological model of risk (Johnson, 1994), cultural and linguistic difference do not produce deficits and it is the responsibility of the school to recognize, accommodate, and value the language and cultural norms children bring with them to school (Dudley-Marling & Lucas, 2009; García & Guerra, 2004; González, Moll & Amanti, 2005; Gutiérrez, 2008; Valencia, 1997; Weiner, 2006). It has been noted that many students from CLSD backgrounds are often quite capable and resourceful and are participants in adult-like experiences. For example, Gonzalez, Moll, & Amanti (2005) gathered evidence that, at home and in their communities, CLSD children often hold positions of responsibility (e.g. language interpreters for their parents; child care of younger siblings; contribution to the economic wellbeing of the household).

It is important not to "villainize" teachers in the discussion of deficit thinking and to note that most teachers are caring individuals who because of their monocultural teacher preparation programs are often unaware of the nature of culture and how culture may impact schooling (García, & Guerra 2004; Hollins, 2008; Nieto & Bode, 2008). This applies not only to White teachers, but to teachers of color as well, even when they are teaching students from their own ethnic background (Trumbull, Rothstein-Fisch, Greenfield, & Quiroz, 2001), (i.e. there may be social class, gender, religious, and other differences between teachers and students that add to the complexity of the caring/teaching process). For example, in some non-mainstream cultures, one way mothers tend to express caring is by teaching children to freely share possessions. In fact "possessions" may not be understood by non-mainstream parents as belonging to only one child to the extent reflected among mainstream parents and teachers. For example, a child may take a pencil from another child's desk. Non-mainstream parents my see this as an acceptable action based on caring for one another through sharing while mainstream culture teachers may see this same action as stealing. Mainstream teachers then may express their caring by trying to instill the "proper" values by punishing the child who took the pencil. However, the punishment may bewilder the parents and students from CLSD backgrounds who may not view the pencil as belonging to only one child.

Teachers from the mainstream culture may hold the deficit viewpoint that the parents do not care enough about their children to instill the proper values of respecting others' property. Furthermore, the teacher may extend their deficit views to the parent's child-rearing style and refer the parents to parenting classes or try other means to encourage parents to change parenting styles (Trumbull et al.). It is therefore essential, that teachers engage in culturally responsive teaching and become more familiar with the students' cultures and family and community norms for caring.

***Limitations of traditional approaches to mathematics instruction*.** In the schooling process, instructional practices are grounded in the host culture, which is viewed as the norm, thereby promoting a Euro-centric universalistic perspective on learning (Banks & Banks, 2007; Hollins, 2008). Learning is viewed as being detached from culture and is not connected to prior learning outside of school. The impact of culture on schooling can be inferred from the uniformity of values and practices across school districts. This is particularly true of the universality and uniformity of school mathematics curriculum and instruction. Math curriculum and instruction look essentially the same whether it is being taught in the U. S. or in India, Africa, the Philippines or other societies colonized by people of European Ancestry. Mathematics itself is seen by some as a tool of cultural imperialism (Bishop, 1990; Rowlands, & Carson, 2002; Swetz, 2009; Vithal & Skovosmose, 1997) Traditionally, mathematics has been considered to be a universal language that is culture free (Kantner, 2008; Secada, 1983) However, as Gay (2009) points out, the fact that math has been assigned high status among the subjects taught in school is, in itself, an indication of its value-laden status. Similar status is not given to other school subjects such as the fine arts, social sciences and physical education. Because of the perceived universality of mathematics, little attention has been paid to the cultural and linguistic heritages that students of CLSD backgrounds bring to the mathematics classroom.

Traditional mathematics instruction has been more successful in addressing the needs of the generally White, middle class analytic, field-independent, individual learner

(Malloy & Malloy, 1998). These students are typically instructed in ways that encourage them to focus on detail and use sequential/structured thinking, recall abstract ideas and irrelevant details, engage with inanimate material, respond to intrinsic motivation, focus on the task, learn from formal lecture, achieve individually, and emphasize facts and principles. By contrast, many students from CLSD backgrounds have other preferences for learning mathematics. They often prefer instruction that encourages students to focus on the whole, use improvisational and intuitive thinking, recall relevant verbal ideas, engage in human and social content material, respond to extrinsic motivation, focus on interests, learn from informal class discussion, achieve interdependently, and narrate human concepts (Malloy & Malloy, 1998). An example of the difference between learning preferences in mathematics for students from the dominant U.S. mainstream culture versus students from CLSD backgrounds might be the following. In teaching children to count, a mathematics teacher in the traditional style may have the cultural routine of taking the finger of a young child and help him or her point to each object that he/ or she is attempting to count while saying the number of the object, e.g. one, two, three…six objects etc. In contrast, a teacher familiar with the learning styles of many of his or her students from CLSD backgrounds may have the child pick out enough objects to share with children in a specified group of six (or other number) children. Teachers who help students use their experiences and cultural preferences for learning to think mathematically are using a culturally based pedagogy (Greer, Mukhopadhyay, Powell, & Nelson-Barber, 2009).

Even with such a modified curriculum, many students are still taught that mathematics only comprises symbolic manipulation. Some students learn with this implementation of the curriculum. However, research has shown that students from CLSD backgrounds are more successful in mathematics when they can see the utility of the mathematics or understand the principle involved. (Rogoff, 2003; Dance, 1997). In instances where students must learn decontextualized facts one study of a second grade classroom where immigrant Latino students predominated showed that when students

were allowed to work cooperatively to learn math facts, they performed better than when they were required to work independently on the same material (Rothstein-Fisch, Trumbull, Isaac, Daley, & Perez, 2003).

Traditional approaches for teaching mathematics tend to disregard the counting systems and algorithms for adding, subtracting, multiplying, and dividing etc. that have developed in different cultures. Ethnomathematics, a recently developed branch of the philosophy of mathematics, posits that culturally embedded mathematics is to be found in all cultures across the globe. For example, algebra, which provides the overall language and conceptions of modern mathematics, was practiced in Arabia centuries before Europeans "discovered" it. Probably the most significant conceptual innovation in the history of mathematics took place in India where the invention of the decimal system with a zero took place. The list could go on with the sophisticated mathematics of the Mayans, Egyptians, Africans, and others. Recognition of the genesis of current mathematical practices would go a long way to interrupt the universalism and Euro-centrism prevalent in mathematics classrooms and make learning more meaning, relevant, and successful for students from CLSD backgrounds.

Other aspects of traditional approaches to mathematics instruction include that they tend to favor teacher-centered approaches, and when more reform-oriented approaches are embraced (NCTM, 1991) they tend to ignore the cultural basis for children's background knowledge in mathematics. Some scholars argue for the use of culturally responsive teaching as a means to use children's background in the instruction of mathematics (Cahnmann & Remillard, 2002; Gay, 2009; Matthews, 2003; Mukhopadhay, Powell, & Frankenstein 2009).

CULTURALLY RESPONSIVE TEACHING

Culturally responsive teaching is a foundational concept of multicultural education, and involves many things: curriculum content, learning context, classroom climate, student-teacher relationships, instructional techniques, and performance

assessments (Gay, 2002a). Central to culturally responsive teaching is the recognition that culture greatly influences teaching and learning. Prominent in culturally responsive teaching techniques is utilizing students' sociocultural background knowledge to meet their learning needs. Children's background knowledge, acquired through personal and cultural experiences, is what gives them access to learning new material (Villegas & Lucas, 2002). Ladson-Billings (1995) defines culturally responsive teaching as an approach that empowers students intellectually, socially, emotionally, and politically by using cultural referents to impact knowledge, skills, and attitudes of students. Gay (2000) defines culturally responsive teaching as "using the cultural knowledge, prior experiences, and performance styles of diverse students to make learning more appropriate and effective for them; it teaches to and through the strengths of these students" (p. 29). Because culture is an all the time every-day phenomenon, students cannot remove themselves from their cultural orientations at will. Therefore, if teaching is going to be effective for students from CLSD backgrounds, it must be culturally responsive.

The key concepts of culturally responsive teaching and teachers have been advanced primarily by four multicultural education scholars: Gay (2002a), Ladson-Billings (1994), and Villegas and Lucas (2002a). Although these authors' conceptions of culturally responsive teaching vary to some extent, they also reflect many similarities. Gay (2002a) advances five descriptive characteristics of *culturally responsive teaching*; Villegas and Lucas (2002a, 2002b) propose six characteristics of *culturally responsive teachers and teaching*; and Ladson-Billings (1994) offers 14 characteristics of *culturally relevant teaching*. By integrating characteristics of these three models I arrived at an aggregated set of 10 characteristics that present a more all-inclusive description of culturally responsive teaching. In this aggregated view, the following characteristics of culturally responsive teaching and teachers emerged. Culturally responsive teachers:

1. Possess sociocultural consciousness,
2. Believe all students can succeed,

3. Have the commitment and skills to act as agents of change,
4. Embrace the constructivist foundation of culturally responsive teaching,
5. Attain knowledge about students and their communities,
6. Encourage a community of learners,
7. View knowledge critically,
8. Use varied assessments that promote learning,
9. Engage in cross-cultural communication, and
10. Endeavor to make classroom instruction culturally congruent.

Culturally responsive teaching embraces all of these characteristics to make learning more successful for students from CLSD backgrounds.

NEED FOR THE STUDY

Latino/a students are the nation's largest group of minority students. Yet, schools have inadequately met the needs of these students. Two factors that support this assertion are the poor achievement patterns and high drop-out rates of this group of students (NCES, 2010b). Due to the presence of various risk factors in the student population such as high rates of poverty, high drop-out rates, and academic underachievement (NCES, 2007-2008; 2010b; Pew Hispanic Center, 2009) Latino/a students are perceived to be a group of students at-risk. For this reason, the current study focuses on Latino/a students. In particular, there is a wide achievement gap in mathematics between Latino/a students and their White counterparts (NCES, 2009b). Though there are several reasons noted in the literature for poor achievement in mathematics, many educators have lamented the lack of culturally responsive teaching in mathematics and the detrimental impact of this omission on student's achievement (Brenner, 1998; Ensign, 2003; Frankenstein, 1995; Greer, Mukhopadhyay, Powell, & Nelson-Barber, 2009; Ladson-Billings, 1997; Lim, 2008). In their recent synthesis, Morrison, Robbins, and Rose (2008) remark that they consistently find that teacher candidates lack the ability to translate culturally responsive theory into to pedagogy in their field experiences. Other researchers also report that there

are few empirical studies of teachers' practice with diverse student populations and that little in mathematics education literature examines how teachers use children's cultural knowledge (Cochran-Smith, Davis, & Fries, 2004; Gutstein et al., 1997). Other researchers have asked what culturally relevant pedagogy in math looks like (Oaks, Joseph, & Muir, 2004). The literature on RTI with minority students calls for culturally responsive evidence based instruction in the general education classroom (Brown & Doolittle, 2008; Drame & Xu, 2008; Harris-Murri, King, & Rostenberg, 2006; Garcia & Ortiz, 2008; Klinger & Edwards, 2006; Utley, Obiakor, Bakken, 2011) yet very little empirical research exists in the area of mathematics with students from CLSD backgrounds who may be struggling or those with learning disabilities. Additionally, there are very few studies that examine culturally responsive mathematics instruction with struggling students in tier one, or the general education classroom.

Other important limitations of extant research are that (a) most of this literature is conceptual in nature; (b) much of the literature on implementation is in the area of literacy; (c) most of the implementation studies in mathematics involve students from CLSD backgrounds other than Latino. Finally, there are very few studies of the implementation of culturally responsive teaching in mathematics where the students and teachers are predominantly Latino. There is a great deal that needs to be known about how teachers can utilize their student's informal cultural mathematics knowledge in the practice of teaching students who are struggling in mathematics.

PURPOSE OF THE STUDY

The purpose of the study, then, is to help fill these gaps in the literature by exploring the implementation of CRT in elementary math classrooms by teachers of predominantly Latino/a students. What appears to be needed by teachers and teacher educators are concrete examples of what culturally responsive mathematics pedagogy might look like and how teachers might use their students' cultural knowledge in mathematics learning. This study will investigate the teaching of successful upper

elementary mathematics teachers with predominantly Latino students in order to identify and describe the implementation of those practices and beliefs that are culturally responsive.

RESEARCH QUESTIONS

Research questions in qualitative research are intended only as an initial guide in the exploration of phenomena (Patton, 2002). The overall purpose of guiding questions is to explore the individual differences in experiences (Campbell & Boruch, 1975). The main questions guiding this research are:

1. What are the features of instruction utilized by elementary math teachers who are successful at teaching math to Latino/a students?
2. How are these features responsive to students' cultural and linguistic backgrounds and personal life experiences?
3. How do their instructional practices with Latino/a students correspond with the theoretical principles of culturally responsive teaching?

I will investigate these questions using a multiple case study design (Yin, 2003) as the guiding methodology for this study. Each math classroom studied will make up a case. Although I will study each selected teacher as a unit of analysis embedded in his or her respective classrooms, the teachers will be instrumental in studying culturally responsive teaching (Stake, 1995). Teacher observations and semi-structured interviews will be the primary means of data collection.

SIGNIFICANCE OF THE STUDY

The present study has the potential to contribute to the literature and scholarship on culturally responsive teaching in mathematics with Latino/a learners in a number of ways. First, preservice and inservice teachers will benefit from having concrete examples of culturally responsive teaching in mathematics with Latino/a learners that may assist them in implementing culturally responsive teaching in their mathematics classrooms. Second, teacher educators will also benefit from these concrete examples as they

endeavor to train future teachers in the practice of culturally responsive teaching in mathematics. Third, the field of special education will benefit from having a description of some of the ways successful teachers implement culturally responsive mathematics teaching in general education, or tier one of a response to intervention model. This study has the potential to make a contribution to the emerging construct of culturally responsive response to intervention in mathematics.

Chapter II: Literature Review

A culture gap exists between students from CLSD backgrounds and the mostly White teaching force. More and more of the nation's school age children are from minority backgrounds while the teaching force remains predominantly White and Euro-centric. Latino/a students in particular are the largest and fastest growing segment of the minority student population. By 2035, one third of all U.S. children and youth will be Latino/a (Population Reference Bureau, 2010).). However, about 86% of all elementary and secondary teachers are White (National Center for Education Statistics [NCES],

2009b). Almost half of the schools in the U.S. do not have a single teacher of color on the staff, therefore many students will graduate from high school having been taught only by White teachers (Jordan-Irvine, 2003). Additionally, in schools where minority students are the majority, two thirds of the teachers are White. The immediate future will not be very different because 80% to 93% of all teacher education students are White females (Cochran-Smith, Davis, & Fries, 2004).

A number of researchers and scholars (Campbell-Jones & Campbell-Jones, 2002; Ferguson, 1998; Gay, 2000, 2009; Ladson-Billings, 1994; Ogbu, 1994; Sadowski, 2001; Sleeter, 2001; Steele, 1992; Weisglass, 2001) in education posit that the cultural gap between students of color and their mostly White Euro-centric teachers may lead to misunderstanding and misperception of minority students by their teachers and is implicated in the underachievement of students from CLSD backgrounds in U. S. schools. For example, 50% of Hispanic 4th graders scored below basic in reading while 42% of 8th graders did. In mathematics, 29% of 4th grades scored below basic in mathematics while 43% of 8th graders did (NCES, 2009a).

Specifically, the literature on effective schooling for students from CLSD backgrounds proposes that one of the major influences on underachievement is the failure of teachers to connect students backgrounds and socio-cultural experiences to their learning (Gay, 2000; 2009; Ladson-Billings, 1994, 1995; Sleeter, 2001; Villegas & Lucas, 2002) However, White teachers, as a whole, have very little cross-cultural knowledge and experience to bring to their teaching of diverse students. Schultz, Neyhart, and Reck (1996) found that most White preservice students in their sample were naïve about the role of culture in education and held stereotypic beliefs about children from CLSD backgrounds. Many White Euro-centric teachers believe that culture does not affect education and don't realize the importance of bringing the cultural background experiences of their students into their teaching (Gay, 2000; 2009). These problems carry over into the classroom and may result in lowered achievement for students of color (Sleeter, 2001; Thomas & Stevenson, 2009).

CULTURE IN EDUCATION

Gay (2000) asserts that culture is at the heart of all that we do in education. This is true whether we are considering curriculum, instruction, administration, or performance assessment. Culture is a major determinant of how we think, believe, and behave, and these in turn affect how we teach and learn. Garcia and Dominguez (1997) add that culture influences what is taught, the characteristic way in which it is taught, and who is responsible for the instruction. As George and Louise Spindler (1994) explain:

> Teachers carry into the classroom their personal cultural background. They perceive students, all of whom are cultural agents, with inevitable prejudice and preconception. Students likewise come to school with personal cultural backgrounds that influence their perceptions of teachers, other students, and the school itself. Together, students and teachers construct, mostly without being conscious of doing it, an environment of meanings enacted in individual and group behaviors, of conflict and accommodation, rejection and acceptance, alienation and withdrawal (p. xii).

Wade Boykin (1994) remarks that "there has always been a profound and inescapable cultural fabric of the schooling process in America" (p. 244).

Defining Culture

There are various definitions of culture offered in the literature. Hollins (2008) says that culture is difficult to define because it is so much a part of who we are and how we live in the world. Generally, culture is the understandings that people acquired through their experiences including their beliefs about relationships and how to interact with the physical world. The essence of culture is not its manufactured objects, tools, holidays or other concrete cultural elements but how the members of the group understand them. Barrett (1984) defines culture as "the body of learned beliefs, traditions, and guides for behavior that are shared among members of any human society" (p. 54). Carter (2000) defines culture as "learned patterns of thought and behavior that are passed from one generation to another and are experienced as distinct to a particular group" (p. 865). And Bullivant (1993) simply defines culture as a groups' program for

survival in and adaption to its environment. A culture's beliefs, values, and understandings are what sets it apart from other groups and holds a specific ethnic group or social class together (Kuper, 1999; Townsend, Thomas, Witty, & Lee 1996)

Culture can be thought of as existing on two levels; the deep invisible level and the more easily discernable visible level (Hollins, 2008). The distinction between visible and invisible culture has also been called explicit/implicit or overt/covert (Hall, 1959, 1976; Philips, 1983). The deep invisible level has to do with attitudes, beliefs, and patterns of thought or knowledge. The visible level is what is often associated with culture such as food, music, holidays, and styles of dress. The deep levels of culture generally remain invisible to people until they meet members of another culture. When two members of different cultures meet, difficulties can occur because both parties are unaware that certain aspects of their culture exist. Because teachers are often unaware of the cultural differences between themselves and their students form CLSD backgrounds, they may be led to misunderstand and misperceive the behavior of their students.

Some other significant aspects of culture include that, from the viewpoint of members within a culture, their attitudes, assumptions, and ways of knowing are thought to apply to everyone universally and that members tend to be ethno-centric (Carigan, Sanders, & Pourdavood, 2005; Greenfield, Raeff, & Quiroz, 1996; Howard, 2006; McFarland, 2011; Philips, 1983; Sue & Sue, 2003). Universalism is apparent in U.S. education where theories of learning and psychometric tests based on mainstream students are said to be scientifically based and are thought to be applicable to students from CLSD backgrounds who have not been represented in samples (Hollins, 2008; Kalyanpur & Harry, 1999). Ethno-centrism is a term closely allied with universalism and implies that one's own culture is not only universal, but the superior "right" and "good for everyone" set of beliefs, and if the "other" persons' set of beliefs differ, they are thought to be inferior, deficient, undesirable, and "wrong" because they are different (Howard, 2006; Nieto & Bode, 2008). Teachers expect students to behave in certain ways at certain times under certain circumstances, and when they don't meet expectations, they

are assumed to be deficient (Ladson-Billings, 1994). Universalism and ethno-centrism may also be seen in the common assumption in educational systems that one curriculum with textbooks selected for the masses should fit all learners (Beyer & Liston, 1996; Weddington, 2010).

Dimensions of cultural variability. Cultural value patterns describe how members of groups are like one another and how the group differs from other groups. Hofstede (1991, 2001) derived four dimensions of cultural variability from results of his large scale study of a U.S. multinational business corporation. He conducted two surveys where there were 116, 000 respondents from 50 countries. Based on the results, he identified four organizational value patterns across a range of diverse cultures. The four value patterns are: individualism-collectivism, small-large power distance, weak-strong uncertainty avoidance, and feminine-masculine value pattern. Hall (1989) adds a fifth dimension of high-and low-context communication. Though there are other cultural variability dimensions, these five are most strongly represented in the literature. Each of these value patterns represents a continuum and each culture and individuals within the culture exist at some point along the continuum with no society representing extremes. Both ends of the continuum exist in all cultures. Hofstede reiterates that ethnic and religious groups, gender, generation, social class, and social structure exert a strong influence on the value patterns within a particular culture. Therefore, there is much variability within a given culture. The five value dimensions should be viewed as an attempt at a systematic comparison of a range of cultures on an aggregate, group level (Ting-Toomey & Chung, 2005).

Individualism-collectivism. Ting-Toomy & Chung (2005) identify individualism-collectivism as the most important value pattern in the formation of individual identity within a culture. Individualism refers to the emphasis in a culture of the importance of individual identity over group identity, individual rights over group rights, and individual needs over group needs. Individualism promotes self-efficacy, individual responsibility, and personal autonomy. Collectivism refers to the tendency of the group to emphasize the

"we" identity over the "I" identity, group rights over individual rights, and in-group needs over individual wants and desires. Collectivism promotes group harmony and interdependence. Mainstream U.S. society tends to be high in individualism (Hofstede, 1997).

A key factor that determines differences between individualistic and collectivistic cultures is how they view group membership. Members of individualistic cultures may belong to many different groups to whom they hold comparatively weak social ties. No one group holds a great deal of influence over its members although some will have more influence than others (e.g. the immediate family). Members of collectivist cultures make sharp distinctions between the groups they belong to (their in-groups) and other people (their out-groups). They tend to belong to comparatively fewer in-groups than members of individualistic cultures and to rank these groups in order of importance. Their dominant relationships were most likely formed early in life and these are ranked as being more important than out-groups.

Differences in group membership orientations between teachers and students can result in culture clashes in the classroom (Hofstede, 1997). Teachers from individualistic orientations are likely to expect each student to make individual contributions to class discussions, but students from collectivistic orientations may prefer to avoid distinguishing themselves from the group by volunteering an answer or to confer with peers before answering (Rogoff, 2003). In collectivistic cultures, greater emphasis is placed on group harmony and group goals with little emphasis on competition or standing out. In addition, in many collectivistic cultures, children are not often asked to share knowledge with others or be asked what they are learning. The role of sharing opinions is reserved for those with higher status (Trumbull, Rothstein-Fisch, Greenfield, & Quiroz, 2001). Individualism can also be seen in the often heard admonishes in schools to "do your own work" and "don't talk with your neighbors." Teachers must teach the expectations of the mainstream culture while at the same time showing respect for their student's culture.

Disciplining students is another area where differences occur between individualistic and collectivistic orientations in schools. Students from individualistic cultures may expect a direct approach to discipline whereas students from collectivistic cultures may value more highly concern for the feelings of others and avoiding embarrassing members of the in-group. Teachers from the individualistic orientation may attempt to discipline a student by saying in front of the class "I am extremely disappointed in your behavior." The student from a collectivistic background may find this extremely embarrassing as harmony and face saving are central values. A more appropriate action by the teacher might be to take the student aside privately and say "Your behavior reflected badly on our class" (Chamberlain, Guerra, & García, 1999).

Small-Large power distance. The power distance value dimension refers to the extent to which groups subscribe to the ideology of equal power in interactions within society. People in small power distance cultures tend to value equal rights and equitable rewards and punishments on the basis of performance. People in large power distance cultures tend to accept unequal power distributions, hierarchical rights, and rewards and punishments based on age, rank, status, title, and seniority. In small power distance societies, equality and personal rights are valued, while in large power distance societies, respect for hierarchy is a basic value (Ting-Toomy & Chung, 2005). The U. S. is considered to reflect a moderately small power distance orientation (Hofstede, 1997).

In schools, children from larger power distance societies may be more reliant on authority and expect the teacher to tell them what to do and would not talk back to the teacher (Rogoff, 2003). In smaller power distance societies teachers may use a more indirect approach to classroom management and children may readily approach teachers and even contradict them expecting to know the "why" behind directives (Chamberlain, Guerra, & García, 1999).

In some cases where European American teachers are teaching minority students, students may mistake a teacher's indirect methods of managing a classroom for weakness. The teacher may value an internal locus of control or self-control over external

control. The teacher may believe that self-control is essential for the development of independence and initiative. Parents also might wonder why the teacher doesn't simply tell the students what to do or how to behave. However, it must be remembered that not all authority looks the same even across collectivistic cultures. For example, elementary teachers from Alaskan (Yup'ik Eskimo) and Japanese backgrounds may reflect a more friendly attitude rather than directive or punitive and believe that children should learn to manage their own behavior within the group. However, in these cases, support to control one's behavior also comes from the group (Trumbull, Rothstein-Fisch, Greenfield, & Quiroz, 2001).

Weak-strong uncertainty avoidance. Uncertainty avoidance refers to the extent to which members of the culture do not mind conflicts or uncertain ambiguous situations and the extent to which they will go to avoid uncertain situations. In weak uncertainty avoidance cultures, members are encouraged to take risks and not necessarily to avoid conflict. Norms and rules are not as clear-cut and rigid as those in strong uncertainty avoidance cultures. In strong uncertainty avoidance groups members prefer clear procedures and conflict-avoidance behaviors. These cultures tend to have clear norms and rules to guide behavior for virtually all situations. There is also a strong desire for consensus in strong uncertainty avoidance cultures, and deviant behavior is not acceptable (Ting-Toomy & Chung, 2005). U. S. culture is considered to be moderately weak in uncertainty avoidance (Hofstede, 1997).

Students from high uncertainty avoidance cultures are more likely to prefer structured learning environments with clear guidelines for behavior, explicit directions, and strict timetables They may be more interested in finding the one correct answer and are more likely to be uncomfortable with change and competition. In contrast, students from weak uncertainty avoidance cultures are more likely to value broad-open ended assignments with little time constraints (Chamberlain, Guerra, & García, 1999). .

In high uncertainty avoidance cultures, teachers are looked upon as experts. Parents may be brought into the classroom as observers, but are not consulted.

Conversely, in weak uncertainty avoidance cultures, teachers actively seek parental involvement and ask parents for input into the learning of their student (Chamberlain, Guerra, & García 1999).

Femininity-Masculinity. In femininity oriented societies, gender roles are fluid and can overlap, that is, whatever a woman can do, a man can do. Both sexes are expected to be modest, observant, and tender and are connected with the quality of the environment. Masculinity refers to societies where gender roles are clearly distinct. Men are expected to be assertive, tough, and focused on task-based accomplishments and material success whereas women are to be more tender and concerned with the quality of life In "feminine" cultures, boys and girls are taught to be caring and concerned with both facts and feelings. In "masculine" cultures, boys learn to be assertive and tough. "Masculine" cultures stress achievement and are more success oriented (Ting-Toomy & Chung, 2005). The U. S. tends more toward the masculine end of the continuum (Hofstede, 1997).

Low-high context communication. Hall (1976) adds an additional continuum that has implications for teachers and students. That is the low-high context communication continuum. High-and low-context communication is the degree to which people rely on context and nonverbal messages to convey meaning or whether they communicate in a direct explicit verbal style. Members of individualistic cultures tend to use low-context communication and communicate in a direct explicit fashion. They depend on their words to convey the meaning of the communication. Members of collectivistic cultures, in contrast, tend to use high-context messages where maintaining in-group harmony is important and communicate in an indirect implicit fashion. They depend on the context to convey much of the meaning of the communication (Ting-Toomy & Chung, 2005). The U. S. has a low-context communication orientation (Hofstede, 1997).

Teachers form a low-context orientation say what they mean and get right to the point. For example a teacher from a low-context orientation might say "stop talking and get out your book" whereas a teacher from a high-context orientation might say "the bell

has rung" (Chamberlain, Guerra, & García 1999).The discrepancy between these two orientations is evident during the writing and telling of stories is school. The child from a low-context orientation would likely write stories using a logical-sequential framework, while students from high-context orientations tend to tell stories as a string of episodic events that revolve around people and their relationships (Hyon & Sulzby, 1992; Mikkelson, 1990). For teachers with a low-context orientation, these stories may appear to be disconnected fragments with no structure, no flow, and follow no rules.

This dimension also has implications for behavior management. If a student is talking with his neighbor during class, a teacher from a high-context orientation might say "turn around and get to work." Whereas a teacher from a low-context orientation may give the student a long silent stare to convey the message that the behavior is unacceptable. Teachers and students will inevitably attempt to communicate with each other in the style in which they are the most comfortable and which they expect from others. If communication styles are incongruous, it can lead to miscommunication and bewilderment at why they are being misunderstood.

These five dimensions of cultural variability provide a lens for how membership in a culture impacts people's behavior. Culture especially influences how people communicate. Understanding this fact may help teachers understand that behavior that appears to be unacceptable is often the result of a different cultural orientations rather than the result of disrespect or lack of effort.

When thinking of these different group tendencies, it must be kept in mind that because culture is constantly being socially created, and because individual identities are created through the interaction of race, class, gender, disability, religion and other experiences, it cannot be reduced to static characteristics or essences (Gutstein et al., 1997). We cannot assume that cultural practices are uniformly homogeneous in any culture (Moschkovich & Nelson-Barber, 2009).

The culture of the mainstream U. S. society and the cultures of many students from CLSD background are often at different places on the cultural value continuums.

The mainstream U.S. culture value orientations tends to be more individualistic, have smaller power distance, and weak uncertainty orientations to society while many of the cultures of minority students tend to be more collectivist, have larger power distance, and strong uncertainty avoidance. The U. S. tends more towards the masculine end of the continuum while many Latin American and Asian countries tend more toward the feminist end of the continuum with the exceptions of Venezuela, Mexico, and Japan who tend to have a more masculine orientation to their societies than the U. S. (Itim International, 2011) Different cultural value orientations between teachers and students are part of the invisible aspects of culture that can "clash" in the classroom and pose particular challenges for teachers teaching students from CLSD backgrounds if they are unaware of these differences. The understanding of culture and the different value orientations possible between cultures provides part of the basis for the cultural discontinuity that occurs between White teachers and students from CLSD backgrounds.

CULTURAL DISCONTINUITY

The term *cultural discontinuity* is equated in the educational research literature with comparable terms such as *cultural conflict* (Vega, Khoury, Zimmerman, Gil, & Warheit, 1995), *cultural dissonance* (Bell & Clark, 1998; Ladson-Billings, 1995; Portes, 2001), and *cultural misalignment* (Tyler, Boykin, & Walton, 2006). Cultural discontinuity can be described as the disconnect between the children's home environment and that of the school (Cholewa & West-Olatunji (2008). It is the behavioral process by which cultural value-based learning preferences and practices are discontinued at school (Tyler, & Uqdah, et al., 2008).

Although Ogbu (1982) suggested that all children undergo the process of cultural discontinuity at school, students from CLSD backgrounds experience this to a greater degree (Gay, 2000; Ladson-Billings, 1994, 1995; Nieto, 1999). The work of Ramirez and Castaneda (1974) and Valenzuela (1999) for example, suggest that educational systems tend to strip Mexican American children of their culture and identity. Hugh Mehan

(1998) suggested that "all students, but especially those from low-income, ethnic-and linguistic minority families, are forced, under normal circumstances, to learn the tacit rules of the classroom culture" (p. 249). Similarly, Geneva Gay (2000) wrote that

> Most teachers…expect all students to behave according to the schools cultural standards of normality. When students of color fail to comply, the teachers find them unloveable, problematic, and difficult to honor or embrace with equivocation. Rather than build on what students have in order to make their learning easier and better, the teachers want to correct and compensate for the "cultural deprivations." This means making ethnically diverse students conform to middle-class Eurocentric cultural norms (p. 46).

For Gay, the discontinuance of cultural value-based behaviors and conformity toward mainstream cultural norms precedes the academic difficulties faced by many ethnic minority students. Similar statements have been made for Latino/a, Asian

Table 2.1: Level of Math Achievement for Hispanic and White Students in Grades Four and Eight (2009)

	4th Grade		8th Grade	
	Hispanic	White	Hispanic	White
Below basic[1]	29	9	43	17
At basic	49	40	40	40
At or above proficient	22	51	17	44
At advanced	1	8	2	11

Note. All figures from: NCES, 2009a

[1]"Basic" denotes partial mastery of knowledge and skills that are fundamental for proficient work at a given grade. Below basic, therefore, denotes less than this level of achievement

American, and Native American students (Garret, Bellon-Harn, Torres-Rivera, Garret, & Roberts, 2003; Howard, 2006; Nieto, 1999) Cultural discontinuity is reflected in lack of achievement for Latino/a youth. See table 2.1 for achievement data for Hispanic versus White students in mathematics.

In addition to underachievement, cultural discontinuity can affect the teaching and learning process in a number of other ways. For example, misunderstandings based on different value orientations and other cultural beliefs can lead teachers to make mistaken attributions about student behavior causing educators to locate difficulties within the child (Gay, 2000; Ladson-Billings, 1994). Mistaken attributions about behavior may lead to some students receiving more corporal punishment and be suspended at higher rates (Townsend, 2000). Cultural discontinuity has also been linked with symptoms of psychological distress in low-income and culturally diverse students in schools (Fisher, Wallace, & Fenton, 2000; Smokowski & Bacallao, 2007) Teachers may hold negative racial attitudes towards and beliefs about students from CLSD backgrounds (Bennett, 1999; Hollins, 2008; Ladson-Billings, 1994; Nieto, 2000). Communication, styles of thinking, language, behavior, relationship towards individuals or groups, and relationship toward authority are several other areas where culture can influence teacher-student and student-schooling interactions (Betsinger, Garcia, & Guerra, 2000; Chamberlain, 2005).

SOCIETAL CONTEXT FOR CULTURAL DISCONTINUITY

Demographics. Latino/a students are the focus of this research because they are the largest group of minority students in the U.S. and are considered to be students at-risk for educational failure. Latinos/as are an extremely diverse group of people. For example, most of the 1,786.000 Cubans in the U. S. fled Cuba in the early 1960's and came from educated middle-class professional families. The majority of Cubans settled in South Florida. The 4, 620,000 Puerto Ricans are U.S. citizens but most that live on the mainland emigrated from the island between 1945 and 1960, arrived poor, and few have improved their lot. The majority of Puerto Ricans who live on the mainland live in New York and

New Jersey. The largest group of Latinos/as in the U.S. is of Mexican ethnicity and is in itself a very diverse group of people. The 31,798,000 Mexicans in the U.S. are complexly stratified by race, class, ethnicity, bilingual or monolingual (either Spanish or English) status, and generation in the U.S. The original Spanish and Mexican settlers of the Southwest were more wealthy land owners but have been joined by wave after wave of Mexican immigrants since the 1880's (Gutiérrez, 2004). Almost half of all Hispanics live in the states of California where they make up 36.3% of the total population and Texas where they make up 36.2% of the population. However, New Mexico has the highest percentage of Hispanics making up their population, at 45.1%. To this mix, add immigrants from the Caribbean and Central and South America and the complexity of the Latino identity becomes apparent (Pew Hispanic Center 2011; Gutiérrez, 2004).

The 2010 Census counted 50.5 million Hispanics in the United States, making up 16.3% of the total population. The nations' Hispanic population grew 46.3% over the past decade, and even more sharply in Southwestern states. Hispanics are projected to make up 25% of the U.S. population by 2050. Mexicans are the largest population of Hispanic origin living in the United States, accounting for nearly two thirds of the U.S. Hispanic population (Pew Hispanic Center, 2007). Hispanics are concentrated at the bottom of the economic ladder. For example, the average income for all Hispanics in 2008 was $21, 488.00, and $20,238 for Mexicans, compared to $24,951 for Blacks, $31, 570 for Whites, and $35, 542 for Asians (Pew Hispanic Center, 2007; 2008).). See table 2.2 for demographic comparisons between Hispanics and Whites in the U. S. concerning average age, child poverty rates, level of education, and participation in the workforce. It is worthy to note that poverty rates are not due to adults not working, but to lower levels of educational attainment (Gutiérrez, 2004).

Cultural discontinuity is suggested in the demographics between teachers and students. Currently nearly 45% of U.S. students are from CLSD backgrounds while about 86% of all elementary and secondary teachers are White (NCES 2010c), 7% are African American and 7% are Hispanic. Teachers are generally female with 84% of elementary

teachers being female (NCES 2012). In 2007-08 44% of teachers were under 40 and 52% had a master's or higher degree (NCES 2011). Teachers are also middle-class and have an average income of $53,000 compared to $21,488 for Hispanic families and $24,951 for Black families (Pew Hispanic Center, 2007, 2008; U.S. Census Bureau, 2009).

Table 2.2: Demographics by Ethnicity

Demographics	Ethnicity	
	Hispanic	White
Average age[1]	27%	36%
Child poverty rates[2]	34%	11%
Less than a 9th grade education[1]	24%	3.2%
College graduates[1]	30.7%	12.9%
Male participation in the work force[1]	85%	77%

Note. [1]Pew Hispanic Center (2007-2008). [2]National Center for Children in Poverty (2009).

Historical background for cultural discontinuity. It could be argued that much of what we know today as European/American culture has its roots in the Enlightenment period, roughly late 15th century to early 19th century. Scientific exploration of various phenomena began in earnest during this period. With scientific discovery as the impetus, what was considered true knowledge was based on what was observable and measurable. Ontology, or reality, was considered to be objective truth. It was the role of the researcher scientist to discover this objective reality through the scientific process of hypothesis testing, observation, and measurement. A thing was considered real only if it could be measured (Atherton, 1993). Objective reality was thought to apply universally and was considered superior to subjective ways of knowing. "Truth" was separate from the observer, and was thought to be discovered through the scientific process. The scientist

tried to distance him/herself from all subjective judgments, emotionalism, and values as these were thought to contaminate reality. Western European-American ideals such an individualism, natural rights, and personal freedom were formulated during this time.

The period of the Enlightenment saw massive exploration of the world by people of European descent. Europeans came into contact, often for the first time, with people of other continents who bore some minor physical differences to the Europeans. Europeans explained these differences using their new found knowledge of science and taxonomy. They considered people with differences to be a different species of people altogether. The European explorers assumed these non-Europeans were inherently inferior, in part due to the fact that their technology was considered inferior since they did not use it to successfully repulse the invaders. The Europeans used this presumed superiority to justify the conquest and subjugation of other people. The Europeans viewed land ownership differently than many of the people they came into contact with. Since many of the non-European groups of people didn't have fences or titles to the land they lived on, the Europeans believed the land was theirs for the taking. Ladson-Billings and Tate (1995) and Ladson-Billings (1998) point out that "property rights" of European/Americans extended not only to land, but also to those subjugated groups of people forced into slavery as well as women and children. She makes the point that property rights may also include the privileges associated with being of European descent.

Deficit thinking. The history of European/American ontology, conquest, and culture is important to the discussion of the reasons for the cultural discontinuity and academic underachievement students from CLSD backgrounds. Ideas of the inherent inferiority of the poor and people of color are still active today and impact the quality of education that students from CLSD backgrounds receive (Duncan, 2005; Garcia & Dominguez, 1997; Ladson-Billings, 1994; 1998). Rather than blame insufficient educational practices for underachievement the child and his/her family culture is blamed. Not only are poor students and students of color often seen as physically and mentally inferior, their culture is thought to be deficient. These ideas are so ingrained in

European American culture and thought that they are rarely closely examined and are part of the basic assumptions many educators bring to teaching.

"Deficit thinking" is the term applied to the belief of the inherent inferiority of people of color and the poor of all ethnicities. In actuality, the term deficit thinking is a soft safe code word for racism and classism prevalent in society. Ladson-Billings (1998) says racism is as healthy today as it was in the Enlightenment. She posits that race has not been systematically employed in the analysis of educational equality. She goes so far as to say that race is the central construct for understanding inequality. Therefore, no attempt to understand the underachievement of students from CLSD backgrounds will be adequate without examining the ways racism and classism impact the daily lives of minority students. Few people today would acknowledge racism in society. Racism today is commonly thought to occur only on an individual level and is due to individual ignorance. If a person is not involved with individual acts of racism, the belief is that no racism occurs. However, racism today has taken the much more subtle form of institutionalized racism. Institutionalized racism has to do with privileging those of European descent in government, laws, the economy, and education. Whiteness, White ways of knowing, White culture, is seen as normative. Even the changes in law that came about during the civil rights era have had a more positive impact on Whites than on people of color. For example, desegregation, which was overtly to benefit Black people, has covertly been more beneficial to Whites (Ladson-Billings, 1994).

Deficit thinking places responsibility for student underachievement on the child and his or her family. From a deficit orientation, children from ethnic minority or poor backgrounds are seen to be disadvantaged, deprived, or at-risk for school failure. However, the ecological view of risk places responsibility for learning failure on the interaction between the school system and students from CLSD backgrounds rather than primarily on students.

An ecological view of risk. During the 1960's, ethnic minority and students from poor families were being described in educational literature as disadvantaged or deprived.

It was thought that these students came from social groups that were inherently disadvantaged or deprived along socioeconomic and sociocultural lines (Havighurst, 1966; Morland & Romanda, 1968). By the 1980's, such terms were incorporated into the broader category of "at-risk" students. At-risk students were defined as those who had normal intelligence but who were failing to achieve the basic skills necessary for success in school and life (Slavin, 1989). The at-risk model assumes that the cause for student's failure in school reside primarily if not exclusively within the child. "Just as disease is understood as the exclusive property of the infected individual, so too learning problems are conceptualized as the exclusive property of the student" (Fedoruk, 1989, p. 41). It was believed that students were placed at-risk by virtue of innate inadequacies and/or due to deprived, unhealthy homes.

More recently, however, ecological theory has perceived student development, learning, and behavior as manifestations of child-environment interactions (Adelman, 1992; Burns, 2011; Foster, 2004; Johnson, 1994). Students at risk are those who experience disadvantageous and discordant interactions in their environments. Silverman, Davidson, and Weintraub (1979) posit that "the dynamics of interaction between the child and the learning situation account for a substantial number of school learning problems" (p. vi). In the ecological view, individuals are an inseparable part of a system and that a disturbance is not viewed as a disease located within the body of the child, but rather a discordance in the system (Apter & Conoley, 1984; Burns, 2011). Educational ecologists would suggest that children are at risk when they find themselves in learning environments for which they are ill equipped. In the ecological view, child characteristics are viewed as more or less appropriate or congruent with environmental characteristics such as the school learning environment. All child-environment interactions are appraised in terms of the *goodness of fit* between child characteristics and environmental requirements (Johnson, 1994). A goodness of fit between what the child brings to the learning situation and what the learning situation requires of the child results in positive outcomes. Thus, teaching style and curriculum are judged in terms of the goodness of fit

with child characteristics. Culturally responsive teaching aims to increase child-classroom congruence or goodness of fit, thereby decreasing students risk level.

Critical race theory. Critical race theorists (Bell, 2004; Dixson,. & Rousseau, 2005; Duncan, 2005; Ladson-Billings, 1998; Lynn, 2004; Stanton-Salazar, 1997) take the position that race still matters in U. S. society as much today as it ever has. Critical race theory maintains that Whites construct reality through stories and discourses that maintain white power. Duncan (2005) points out that allochronic (referring to different geologic times) discourse gives oppression an appearance of normalcy and naturalness. Critical race theory has sought to bring out the stories of people of color, their discourse, their ways of knowing, as a corrective to institutionalized racism. Duncan (2005) says that these different discourses come about due to differences in ontology and epistemology. Specifically, Duncan points out that European/American discourse is heavily influenced by ideas of objective reality whereas many non-European based cultures emphasize subjective or lived reality. One of the major difficulties with objective ontology and epistemology is that it excludes reality based on anything that is not observed and measured, such as the stories told by those who experience racism on a daily basis.

In education, critical race theory sees standardized curriculum and assessment as one of the ways that Whites maintain power in U. S. society. For example, students from CLSD backgrounds frequently receive less rigorous curriculum, are more often taught by less experienced teachers and their schools more often lack sufficient funding (Kozol, 1991; 2005). Their teachers more often use pedagogy, methods, and materials which have not been evaluated for effectiveness with minority students (Sze, 2005). They are overrepresented in special education and underrepresented in gifted programs (Ford, Grantham, Whiting, 2008; Salend & Garrick-Duhaney, 2005). Assessments used to determine eligibility for special programs are biased toward dominant U. S. culture (Abedi, 2002; Chamberlain, 2005; Garcia & Dominguez, 1997). In the literature on educating students from CLSD backgrounds, racism in the guise of deficit thinking on the

part of educators has been a powerful determinant of the underachievement of students from CLSD backgrounds.

Sociocultural and constructivist view of learning. The nature of teaching and learning are different depending on differing conceptions of what reality is and what is considered important to know. Education in U. S. schools is based more on the objectivist/positivist paradigm with a good dose of individualism apparent. Positivist educational/behavioral theorists such as Skinner and Thorndike held the more traditional view, to put it simply, that teaching and learning entails the transfer of a body of knowledge, known as the curriculum, into the head of the learner. Teachers and educators are the experts in knowledge. Students and parents are to comply with school goals and objectives. In the U. S. this means then that whatever the dominant culture decides is necessary and important knowledge becomes the curriculum, and all students are instructed in the same ways, with the same materials, same objectives and assessments. While this may work well for middle class European Americans, it may contribute to cultural discontinuity for students from CLSD backgrounds. Students from CLSD backgrounds often come from cultures that have different truths deemed most important, and different ways of knowing based on subjective reality.

Subjective reality in education is not, however, without its apologists, theorists, and philosophers. People such as Marx, Foucault, Piaget, Vygotsky, Chomsky, and Galperin (Arievitch & Haenen, 2005; Lynn, 2004; Mahn, 1999; Packer & Goicoechea, 2000; Smagorinsky, n.d.; Thorne, 2005) have formulated a firm foundation for the authenticity of a more subjective ontology and epistemology based on sociocultural and constructivist ideas.

In contrast to the more traditional positivist educational traditions, sociocultural, multicultural, and constructivist teaching philosophies are more compatible with the cultural orientations of students from CLSD backgrounds (Villegas & Lucas, 2002b). In the sociocultural view, teaching and learning is a process that emphasizes social participation, relationships, the setting of the activity and how knowledge is constructed

on more progressively adequate levels as a result of the learner's activity and interaction with the world (Packer & Goicoechea, 2000). Sociocultural approaches have been used to understand learning in a way that situates culture at the core of education (Nasir & Hand, 2006).

Lev S. Vygotsky is considered the founder of sociocultural and constructivist educational theory and. His work grew mainly out of reflection on Piaget's and Marx's theories. (Mahn, 1999; Smagorinsky, n.d.). Vygotsky's theory of learning differed from Piaget's in that he did not view learning as a simple product of the learner's interaction with the physical world. Instead, Vygotsky posited a zone of proximal development which contained the level of development possible through independent problem solving, and the potential level of development reached with the guidance of an adult or more capable peer (Mahn, 1999).

In Vygotsky's view, learning develops through the interaction of the individual, and natural and social forces. Human beings are inherently meaning makers (Mahn, 1999). In particular, Vygotsky focused on the way a child co-constructs meaning through social interaction and the role word meaning plays in the development of thinking. Central to Vygotsky's thinking about learning was the development of human consciousness through the mediating function of language and other symbolic systems known as semiotic mediation. Vygotsky's major theoretical contributions that are important in education include: the role played by language and other forms of semiotic symbols; the function of social interaction in the development of the human mind; the role of word meaning in complex conceptual thinking; the relationship between elementary and higher mental functions in the development of psychological processes; and the zone of proximal development (Mahn, 1999).

Vygotsky’s theories have been used to support constructivism in education and the need for the inclusion of a child’s cultural ways of knowing and learning in teaching. Culturally responsive teaching is inclusive of the major tenants of a constructivist orientation to teaching. Culturally responsive teaching uses children’s preexisting

knowledge and experiences and recognizes that these are derived from their cultural background. Culturally responsive teaching also specifically seeks to redress the harmful effects of institutionalized racism at the classroom level and to ameliorate discontinuities between student's native cultures and school by supporting and preserving the student's culture and by including student's cultural backgrounds in the teaching and learning process.

CULTURALLY RESPONSIVE TEACHING

Geneva Gay (2000) defines culturally responsive teaching as "using the cultural knowledge, prior experiences, and performance styles of diverse students to make learning more appropriate and effective for them; it teaches to and through the strengths of these students" (p. 29). Central to culturally responsive teaching is the belief that culture extensively influences teaching and learning. All people are social and cultural beings and facets of their humanness reflect their cultural socialization to some degree. Culture is an all the time every-day phenomenon, not something that can be reserved for certain times and events. Teachers and students cannot remove themselves from their cultural orientations at will. Therefore, if teaching is going to be effective for students from CLSD backgrounds, it must be culturally responsive (Gay, 2009). Villegas and Lucas (2002), Gay (2000) and Ladson-Billings (1994) are major authors who have advanced characteristics of culturally responsive teaching and teachers. Though Ladson-Billings prefers the term "culturally relevant teaching," conceptually, it is very similar to what Gay (2000) and Villegas and Lucas (2002) advance as culturally responsive teaching. Therefore, I have synthesized the major tenants of Ladson-Billings' culturally relevant teaching with Gay's and Villegas and Lucas' conception of culturally responsive teaching. The following features represent the major features of culturally responsive teaching as put forth by these scholars and what culturally responsive teachers need to know and be able to do. Culturally responsive teachers: Possess sociocultural consciousness, believe all students can succeed, have the commitment and skills to act as

agents of change, embrace the constructivist foundation of culturally responsive teaching, attain knowledge about students and their communities, encourage a community of learners, view knowledge critically, use varied assessments that promote student learning, engage in cross-cultural communication, endeavor to make classroom instruction culturally congruent.

Characteristics of Culturally Responsive Teaching and Teachers.

***Possess sociocultural consciousness*.** Villegas and Lucas (2002) propose that teachers need to be aware that one's worldview is not universal and that one's perspective is not necessarily shared by others. Due to the differences between most teachers and the students from CLSD backgrounds students they teach, teachers need to expand their perceptions of the world if they are to see and learn from the perspectives of their students. One of the things teachers need to understand and learn about is the system of social inequality in this country. Race, class and gender are all major determinants of social location in this country and differential social location results in unequal power relationships with the middle and upper classes wielding most of the power. One of the places unequal power relationships is seen in schools is in the practice of tracking. Generally, White middle class students are placed in higher track courses while students from CLSD backgrounds are placed in remedial or lower track courses. Tracking is one of the ways that schools help reproduce existing social inequalities (Villegas & Lucas). Ladson-Billings (1994) adds that privileging some children in schools is *dysconscious* racism. Dysconscious racism is different than purposely depriving or punishing students on the basis of their race. Yet teachers engage in dysconscious racism when they fail to challenge the status quo that unfairly privileges White middle class students over students from CLSD backgrounds through practices such as tracking.

One of the things teachers can do to become aware of the diverse perspectives of their students is to acquire a cultural diversity knowledge base by attaining detailed information about the cultural particularities of specific ethnic groups (Gay, 2000). Among characteristics it is important to know are ethnic groups' cultural values,

traditions, communication styles, learning styles, and relational patterns. For example, teachers need to know which groups give priority to communal living and cooperative problem solving, how children are socialized to interact with adults, and the educational implications for different gender role socialization.

Believe all students can succeed. Teachers who believe all students can succeed hold an affirming viewpoint of their students from CLSD backgrounds. An affirming viewpoint acknowledges a variety of legitimate ways of thinking, behaving, and learning (Villegas & Lucas, 2002). It sees excellence as a complex standard that takes student diversity and individual differences into account (Ladson-Billings, 1994). Teachers who respect cultural differences are more prone to believe that students from CLSD backgrounds are capable learners even when these children enter school with different ways of thinking, talking, and behaving. They see all students as already knowing a great deal about the world and who have a variety of experiences, concepts, and languages that can be built upon to help them learn even more (Villegas & Lucas, 2002). Gay (2002) adds that teachers must hold high expectations for students and to work to bring about their academic success. Culturally responsive teachers know that part of believing all students can succeed is helping them develop necessary skills. By building scaffolding that meets students where they are, culturally responsive teaching helps them to be where they need to be to participate meaningfully in the construction of knowledge (Ladson-Billings).

To illustrate this point Ladson-Billings (1994) offers the comments of one of the teachers in her study. This teacher insisted that she had never met an unsuccessful student. She said "you know, they're all successful at something. The problem is that school often doesn't deal with the kinds of things that they can and will be successful at…that's why my class is a constant search for ways to be successful…that's why we do so many projects in my class. I figure if we do enough different kinds of things, we'll hit on the kinds of things kids can be successful with" (p. 45-46).

Have the commitment and skills to act as agents of change. By making the commitment to act as agents of change, teachers can challenge the prevailing perception in education that differences among students are problems rather than assets. Teachers can be located on a continuum between being mere technicians on one end to being agents of change on the other. Teachers located on the technician end of the continuum see schools as neutral institutions that function separately from society. They see teaching primarily as developing technical skills such as competence with certain instructional methods, classroom management techniques, and assessment methods. They see teaching as separate from political and social values and endeavor to be objective when delivering the proscribed curriculum (Villegas & Lucas, 2002).

In contrast, teachers toward the agents of change end of the continuum know that society and schooling are interconnected. They believe without intervention, schools tend to reproduce existing social inequalities by giving preference to mainstream ways of thinking, talking, and behaving. They believe that teachers actions in the classroom either support or challenge inequalities. Teachers who are change agents understand the need for educational change and are willing to participate in bringing about this change. Such teachers develop their vision for social justice, have empathy for students of diverse backgrounds, are aware of the change process, promote activism inside and outside the classroom, and develop skills for united action (Villegas & Lucas, 2002).

EMBRACE THE CONSTRUCTIVIST FOUNDATION OF CULTURALLY RESPONSIVE TEACHING. Proponents of culturally responsive teaching posit that what can be known about the world is always filtered through the knower's frame of reference, beliefs, assumptions, and world view. Knowledge is essentially a human construction because everything is experienced through the knower's lens. The role of the teacher is to help students build bridges between what they already know and believe about a topic and the new ideas and experiences to which they are exposed. Ultimately, each student must build his or her own understanding of the ideas encountered at school. Teachers will, therefore, constantly monitor their student's developing understandings by asking

students to defend their thinking or explain how they arrived at a conclusion. In the constructivist classroom, student's thinking is as important as the products of that thinking, and their problem solving as important as the solutions they come to (Villegas & Lucas, 2002). Ladson-Billings (1994) adds that teachers with culturally responsive practices see teaching as digging knowledge out of students and that a search for important ideas and the construction of knowledge fuels the excitement and enthusiasm that characterize culturally responsive teaching.

***Attain knowledge about students and their communities*.** In the constructivist orientation to education, it is the teacher's role to build bridges between the student's prior experiences and the knowledge that is to be learned. It is self-evident that the teacher must be familiar with his or her students and what their background knowledge consists of (Ladson-Billings, 1994; Villegas & Lucas, 2002). Teachers need to know about the lives and experiences in their communities of the specific students they teach. (Villegas & Lucas, 2002). Teachers did this in Ladson-Billings (1994) study by cultivating the teacher-student relationship beyond the boundaries of the classroom. For example, one teacher actively recruited students in her classroom to be part of her Girl Scout troop. Another teacher arranged for a small group of students to have lunch with her in the classroom.

Teachers who know their student's families are better able to understand in school behavior and to incorporate the families' knowledge in the classroom experiences. Those teachers who also know their student's experiences with classroom subjects outside of school can draw on those experiences to embed them meaningfully in learning activities. In doing so, teachers make knowledge more accessible and relevant to their students. Knowledge of a community's predominant ways of using language, interacting, and approaching learning is valuable to a teacher (Villegas & Lucas, 2002).

Culturally responsive teachers attain knowledge about their student's lives so they can build on students' personal and cultural strengths (Villegas & Lucas, 2002). Part of the student's cultural strength is their linguistic resources. Culturally responsive teachers

encourage students to continue building their native language while becoming fluent in English and use materials in the student's native language where possible.

Ladson-Billings (1994) suggests that not only do teachers need to be familiar with student's communities, but they see themselves as part of that community, see teaching as giving back to the community and encourage students to do the same. Teachers also need to help student's make connections between themselves and their local, national and global communities. For example, in a class's current events lesson, a teacher asked students to make connections between the news items and themselves. She asked what reasons students could offer as to why news issues would be important to the local community.

Encourage a community of learners. Culturally responsive teaching advocates the kind of cooperation between students that leads them to believe that they cannot be successful without getting help from others or without being helpful to others (Ladson-Billings, 1994). Many students of color grow up in communities where the welfare of the group takes precedence over the individual and people are taught to pool their resources to solve problems. The group operates to mutually help one another and ensure that everyone contributes to the task at hand. Therefore, culturally responsive teachers will design more communal learning environments (Gay, 2002). All students should be involved together in the active construction of knowledge and all children benefit when cognitive tasks are shared. Two ways to do this are through the use of inquiry projects and through collaborative small group work. Small group work promotes active learning for all students. Each student may take on a specific role such as record keeper or instructor for the group. Group work can also promote cross-cultural communication and give English language learners the opportunity to hear and use the English language (Villegas & Lucas, 2002).

View knowledge critically. Students will benefit from knowing that the curriculum reflects the perspective of its authors and that those who hold power in society are the writers of the curriculum. An important role of the teacher is to help students

examine the curriculum critically by having them attend to inaccuracies, omissions, and distortions in the text and to broaden the text with multiple viewpoints (Villegas & Lucas, 2002). In conjunction, the teacher can challenge the Euro-centrism of the curriculum (Ladson-Billings, 1994, Villegas & Lucas, 2002). For example, this can be done by analyzing the mainstream conceptualization of westward expansion of the United States alongside accounts from various Native American peoples. Gay (2002) says there are three types of curricula present in the classroom. They are the formal, the symbolic, and the societal curriculum. Each needs to be examined for its cultural diversity strengths and weakness and changes need to be made where necessary to include diversity issues.

Use varied assessments that promote learning. One of the uses of standardized tests in schools is to sort students into different educational tracks (Beyer & Liston, 1996). But if the goal is to educate all students to high levels of educational attainment then assessments must be used in the service of teaching and learning rather than sorting students. More learning oriented assessments ask students to apply their knowledge in the real world rather than to select a right answer from a group of choices. More authentic assessments include portfolios, oral presentations, research projects, and debates. Using a variety of assessments is important because relying heavily on one type of assessment is bound to disadvantage some students (Villegas & Lucas, 2002).

***Engage in cross-cultural communications*.** Culturally responsive teachers know that the participation structures of cultural groups may differ from those expected in the classroom (Villegas & Lucas, 2002). In mainstream schooling, a passive-receptive communication style predominates. In this style, the teacher is the active speaker and students are expected to passively listen. In contrast, many students from CLSD backgrounds are socialized into a more participatory style where learners engage with the speaker by providing prompts and feedback. Another contrasting communicative behavior that may differ between students and teachers is the topic-centered or topic-chaining style of presenting a topic. Teachers tend to expect a more topic-centered approach where students stay focused and stick to the point through the use of a linear

progression of ideas. Students form CLSD backgrounds however may prefer a topic-chaining style where students may provide much background information and add flair and dramatization to the presentation, and use indirectness to convey ideas (Gay, 2000, Ladson-Billings, 1994). Teachers need to understand these discourse patterns and help students understand the expected ways of participating in learning events (Gay, 2000; Villegas & Lucas, 2002).

Endeavor to make classroom instruction culturally congruent. To make classroom instruction culturally congruent is to match student's learning styles with instructional techniques. For example, a story telling teaching style is more congruent with the topic-chaining communication styles of some students from CLSD backgrounds. Motion and movement, frequent variability of tasks and dramatic elements improves the academic achievement of African American students (Gay, 2000; Ladson-Billings, 1994). Ladson-Billings states that culturally relevant teachers see teaching as an art and themselves as artists. Gay (2000) also says that giving examples, scenarios, and vignettes to demonstrate how skills, principles, and knowledge operate in real life connects prior knowledge to new knowledge and abstractions with realities.

THE CONTRIBUTION OF ETHNOMATHEMATICS

Ethnomathematics is an emerging field of study in mathematics. The term "ethnomathematics" was coined by the Brazilian mathematician and philosopher Dr. Ubitatán D'Ambrosio in the early 1980's. Arismendi-Pari (1999) defines ethnomathematics broadly as the study of the interaction between mathematics and culture. Shirley (1992) defines ethnomathematics as the application of mathematics by various cultural groups defined in terms of gender, occupation, age, and ethnicity. Proponents of this view argue that the development of mathematics has not been linear. Rather ethnomathematics challenges the Euro-centric bias in mathematics curriculum by including the rigorous mathematics of Egyptian, Japanese, Chinese, Mayan, Incan, and other cultural groups. Other cultural groups may include groups of engineers, physicists, young children, and seamstresses. These cultural groups may view and manipulate

mathematics differently and their mathematics should be defined as legitimate mathematical knowledge. Differences in mathematical knowledge can be acknowledged and taught in the mathematics classroom to make mathematics more relevant and meaningful to children.

Ethnomathemtaics can contribute to culturally responsive teaching by helping to decenter and interrupt the Eurocentered and universalistic view of mathematics. D'Ambrosio (2001) says the historical contributions that are often described in learning mathematics are all too often Eurocentric, paying undue homage to the fair skinned Greeks as the purveyors of most of our mathematical thought. However, children are seldom taught that the Greek mathematicians, notably Pythagoras and Thales, the legendary founders of Greek mathematics, traveled and spent years in such areas as India and North Africa, where they acquired much of their mathematical knowledge. Children need to be taught that many cultures contributed to the development of mathematics and that members of cultural groups have been and are intelligent, resourceful, and creative. Many children who are failing mathematics simply do not realize that they are mathematically capable and that they do, in fact, possess a long and rich mathematical heritage (D'Ambrosio, 2001).

Mukhopadhyay, Powell, & Frankenstein (2009,) suggest that the scope of ethnomathematics spans at least the following categories:

1. Studies and analyses of the mathematics of social groups in all areas of the world, including marginalized groups for their contribution to mathematical knowledge.
2. Mathematics in out-of-school contexts including "street mathematics" and mathematics traditionally viewed as belonging to women.
3. Revealing the contributions of many cultures to academic mathematics and thereby challenging the Eurocentric narrative in its history and development.
4. Calling attention to how social, cultural, and political contexts influence the development and dissemination of mathematics, countering a history of mathematics that emphasizes the intellectual achievement of individuals.

5. Highlighting and interrogating the practices within mainstream mathematics. As a form of ethnomathematics, academic mathematics has characteristics that make it special. These characteristics, as suggested by Greer (1996) are: the length and complexity of its historical development, the multiplicity of cultures that have contributed to its development, the degree of communication and negotiation that takes place among mathematicians, the technological advances that generated problems and stimulate the development of new mathematics, the creating and codification of abstract mathematics, and the degree of reflection on the nature of mathematics (p. 188).
6. The specific practices of school mathematics. From the perspective of a situated theory of learning Lave (1993) states that:

> …math in school is situated practice; school is the site of children's everyday activity. If school activities differ from the activities children and adults engage in elsewhere, the view of schooling must be revised accordingly; it is a site of specialized everyday activity—not a privileged site where universal knowledge is acquired (p. 81).

The most obvious way to challenge the Eurocentric narrative is to offer a counter narrative. Culturally responsive teaching may include the counter narrative as offered by the study of the contributions of non-European cultures to academic mathematics.

CULTURALLY RESPONSIVE TEACHING IN MATHEMATICS

I had previously written a synthesis on implementation of culturally responsive teaching in mathematics. I found 12 articles that describe teacher practices in elementary mathematics classrooms. Only three out of the 12 articles had Latino/a students as part of their sample of students. I used Gay's (2000) descriptions of culturally responsive teaching as a framework for my findings. Gay says culturally responsive teaching is validating, comprehensive, multidimensional, empowering, transformative, and emancipatory. Table 2.3 contains Gay's (2000) characteristics of culturally responsive

teaching with examples of each. Due to space constraints I will not include all my findings, but offer the descriptive characteristics with a few examples of each.

Table 2.3 Culturally Responsive Teaching Characteristics and Findings

Characteristic	Findings
Validating	
Acknowledges the legitimacy of cultural groups.	Students read literature about the Underground Railroad. Students completed a computer program that incorporated math/science problems as part of the story (Leonard, Davis, & Sidler, 2005)
Builds bridges between home and school.	Teachers established a math game center because parents played math games at home (Brenner, 1998).
	Students brought pictures from home of things that come in groups to apply to learning math (Cahnmann & Remillard, 2002.)
	The teacher used the newspaper and a restaurant menu as a source of math problems (Mathews, 2003)
	Teachers used thematic units that built on students ideas (Civil, 2002)
Uses a wide variety of instructional strategies.	The teacher as well as students posed problems. No activity sheets were used (Ladson-Billings, 1994).

(Table 2.3 cont.)

Comprehensive	Most work was done in small groups (Mathews, 2003).
Incorporates culturally mediated cognition.	Family knowledge was incorporated into mini-books (Civil, 2002).
Incorporates culturally valued knowledge	Teachers adapted Eskimo elder's knowledge to the math curriculum (Lipka et al., 2007).
Multidimensional	Latina teacher shared background with students which allowed
Builds positive student-teacher relationships.	her to provide a nurturing transition between home and school (Cahnmann & Remillard, 2002).
	Teacher made authentic and deeply emotional, familial, cultural, and linguistic connections to students (Lipka, Sharp, Adams, & Sharp, 2007).
	Teacher used "traditional Bermudian friendliness" with her students (Mathews, 2003).
Views knowledge critically.	Teachers pushed children to question and ask "why? why? why?
Empowering	
Orchestrates success.	Teachers changed the order of topics from the textbook to build from children's strengths (Brenner, 1998).

(Table 2.3 cont.)

Teaches substantive content.	A mathematics project included measuring distance on maps and in real life (Tate, 1995). Teachers used all measurement items in the NCTM (2000) for a unit on gardening (Civil & Kahn, 2001).
Shows students they are expected to succeed.	All students participated in algebra although algebra was not required at that grade level.
Transformative	
Is explicit about supporting the cultures and experience of diverse youth.	Teachers did this by supporting student's language and background experience.
Emancipatory	
Students are taught to apply new knowledge to community and social problems.	Students posed problems in the community, researched the problems and instituted solutions to the problems, e.g. AIDS, drugs, ethics in medicine, and cities of the future. Students helped close or relocate liquor stores close to the school (Tate, 1995).

Students Who Are Underachieving in Math and Those with Math Learning Disabilities

Though current educational laws, No Child Left Behind (NCLB, 2001) and the Individuals with Disabilities Education Act (IDEA, 2004), call for scientifically based research in the education of all students, there is a very little of this literature that focuses on teaching students from CLSD backgrounds who struggle or who may have learning disabilities(Ortiz & Yates, 2008, Sze, 2005). Additionally there is almost no scientifically based research that focuses on students from CLSD backgrounds who struggle or who have disabilities in mathematics. For these reasons, the following section will review what is known from the research on struggling students or those with disabilities in mathematics that focuses on mainstream students.

Approximately 5-9% of students in the U.S. may be identified with math disabilities (Badian, 1983; Geary, 2004; Gross-Tsur, Manor, & Shalev, 1996). Although this estimate is similar to the prevalence of reading disabilities, less research has been directed at math disabilities (Ketterlin-Geller, Chard, & Fien, 2008; Rasanen & Ahonen, 1995). However, three recent meta-analyses have been conducted on the features of mathematics instruction that most benefit low achieving students (Baker, Gersten, & Lee, 2002) and students with disabilities (Gersten, Chard, Jayanthi, Baker, Morphy, & Flojo, 2009; Krosbergen & Van Luitt, 2003). These syntheses provide some details about features of instruction that seem to consistently be effective in teaching mathematics to students with difficulties.

Instructional strategies. Based on these syntheses, six main instructional strategies emerge as potentially beneficial for students who struggle in math or those with learning disabilities: (a) visual and graphic depictions, (b) systematic and explicit instruction, (c) student think-alouds, (d) peer-assisted learning, (e) formative assessment data provided to teachers, and (f) formative assessment data provided directly to students.

Visual and graphic depictions. Visual representations of mathematical relationships are consistently recommended in the literature on mathematics instruction (Griffin, Case, & Sigler, 1994; National Research Council [NRC], 2001; Witzel, Mercer, & Miller, 2003). The NRC (2001) report stated that mathematics requires representations, they serve as tools for mathematical communication, thought, and calculation, allowing personal mathematical ideas to be externalized, shared, and preserved. Representations help clarify ideas in ways that support reasoning and build understanding.

Visual representation can be used with verbal problems or computational problems (Gerard, 1990). If a verbal problem asks about the total amount of fruit assembled after a purchase of three bananas, two pears, and one apple, students can draw pictures of these items. The drawings can be abstract rather than representational, containing only enough detail to remind the children of the sketched items' identities. If students have difficulty with visual representations, they can complete structured activities such as mapping, time lines, and spatial diagrams in response to verbal mathematic problems. If learners have difficulty with these alternative strategies, instructors can provide cues that can assist the learner. For example, the cues might comprise portions of the representations that the students are being encouraged to devise. Or students can create representations in groups and share these with each other prior to attempts at computing solutions for problems (Gerard, 1990)

Although activity sheets may be available on which publishers have already provided pictorial representations to assist students in conceptualizing problems, the intensity of the exercise can be increased if students themselves provide the representations. If students make computational errors after constructing visual

representations, the teacher can use the sketches as the subject of a dialogue that may reveal the precise reasons for these errors. Additionally, student-generated representations can be an effective transition for students who were trained with materials that included publisher-supplied representations but who have progressed to less graphic exercises (Gerard, 1990).

Systematic and explicit instruction. A good deal of the special education literature in mathematics has called for instruction to be explicit and systematic (Gersten, Baker, Pugach, Scanlon, & Chard, 2001; Fuchs & Fuchs, 2003; Swanson & Hoskyn, 1998). Gersten and Carnine (1984) define direct instruction as a comprehensive educational model involving (a) a specific curriculum, (b) a specific way of teaching (rapidly paced small group instruction), (c) a specified model of in-service education, and (d) a system for monitoring both student and teacher performance. Students are explicitly taught rules and strategies for solving problems and performing arithmetic computations. To teach these rules, strategies, and concepts efficiently, teachers demonstrate, prompt, and test students on each step of a new skill before expecting the students to work independently. Rules are explicitly taught, modeled, and then practiced and reviewed. Nothing is left to chance; children are not asked to infer generalizations. The program calls for considerable practice with corrective feedback. Teachers are trained to provide immediate corrective feedback to student responses and to model correct problem solving strategy if a student is confused. Principles of mastery learning are adhered to; groups do not go on to the next lesson until mastery is reached on the previous one.

An essential component of direct instruction is continual assessment of both student progress through the program and of teacher performance. Students are given individually administered criterion referenced tests on material covered during the preceding two months. Scores on these tests are used to determine whether a child needs remediation and whether individual students need to be placed in either a more accelerated or slower-paced group. Teachers are observed weekly and given specific feedback (Gersten & Carnine, 1984).

***Student think-alouds*.** Frequently, educators have drawn on the social nature of learning (Vygotsky, 1978) to help increase student independence and promote greater flexibility of thinking (Englert, & Mariage, 1996; Palincsar & Brown, 1984; Scanlon, Deshler, & Schumaker, 1996). The vehicle most commonly used today for maximizing the social nature of learning is elaborated dialogue, also known as interactive dialogue or student think-alouds. Think-alouds is a verbal exchange about a complex cognitive activity among a teacher and students or students with each other. Dialogue can include explicit modeling of strategies, critical evaluation of verbal or written student responses, questioning, and elaborated responses. During these exchanges, students are scaffolded into higher more detailed, and richer forms of expression and processes for higher-order thinking strategies. Approaches that encourage and prompt verbalization are effective for students with LD in a wide array of curricula areas, including content area subjects such as history and science, as well as foundational areas such as reading and mathematics (Baker, Gersten, & Scanlon, 2002). In encouraging students to verbalize thought processes while solving problems, teachers should have students select an appropriate representation and discuss it with peers or the teacher to evaluate its relevance. It can also lead to discussions of which strategies apply to particular situations.

***Peer-assisted learning*.** Students with learning disabilities are often provided with some type of assistance or one-on-one tutoring in areas for which they need help. Sometimes students' peers provide this assistance or one-on-one tutoring. There are two types of peer tutoring. The more traditional is cross-age, wherein a student in a higher grade functions primarily as the tutor for a student in a lower grade (Robinson, Schofield, & Steers-Wentzell, 2005). In the newer within-classroom approach, two students in the same grade essentially tutor or assist each other. In many cases a higher performing student is strategically paired with a lower performing student but typically both students work in the role of tutor and the tutee (Fuchs, Fuchs, Yazdian, & Powell, 2002). Peers work in dyads rather in larger groups of four to six as in cooperative learning strategies. Peers are carefully trained in tutoring procedures. For example, in working on a set of

problems, the higher performing child will work on the problems first and the lower performing child will provide feedback. Then roles will be reversed and the lower performing child will work on problems for which he or she just had a model for how to solve them. Or in providing explanations for math solutions, the higher performing child will provide the explanation first and the lower performing child will have had a model for a strong explanation. Generally, students use their time in peer-assisted instruction practicing math problems for which they have received previous instruction from the teacher. Tutors are also encouraged to represent abstract mathematical quantities with visuals or manipulatives. The use of peers to provide feedback and support is consistently supported by research as a means to improve computational abilities and is a promising means to enhance problem-solving abilities (Baker, Gersten, & Lee, 2002).

***Providing formative assessment data and feedback to teachers*.** Ongoing assessment and evaluation of students' progress in mathematics can help teachers measure the progress of their student's growth and help teachers fine-tune instruction to meet the needs of their students. Information on student progress was gathered using curriculum based measurement and provided to teachers, at times information was included on what skills students needed further remediation on. The addition of skills analysis has been found to add significantly to teachers' ability to enhance student growth in mathematics computation (Fuchs, Fuchs, Hamlett, & Stecker, (1990).

***Providing formative assessment data and feedback to students*.** Providing students with information regarding their performance is considered by many to be a key aspect of effective instruction. Information about performance or effort may serve to positively reinforce student effort, it may serve as a way to keep students accountable for staying on task and working as expected on mathematics problems, and it may provide useful information in understanding where they have been successful and unsuccessful in their learning. Feedback can be provided via a number of sources including teachers, other peers, or computer software programs (Calhoon & Fuchs, 2003)

Additional strategies. In addition to the six instructional practices described above, other instructional strategies have been documented to be effective in supporting mathematics learning for students struggling with learning mathematics. For example, researchers have demonstrated that a graduated instructional sequence that proceeds from concrete to representational to abstract (CRA) benefits struggling students (Maccini & Hughes, 2000; Witzel, 2005; Witzel, Mercer, T Miller, 2003). Concrete instruction is centered on students learning through hands-on manipulations and may focus either on concepts or procedures. After students learn through concrete instruction, they learn to model mathematical problems using pictorial abstract symbols. Finally, when they develop fluency with pictorial representations instruction focuses on abstract symbols. These techniques of scaffolding students' learning of concepts and procedures are also components of effective mathematics instruction for English Language Learners (Freeman & Crawford, 2008). Research focused on the CRA sequence has repeatedly documented significant increases in students' procedural performance with a variety of math topics including basic facts, fractions, perimeter, simple equations, and addition or subtraction of positive and negative integers (Butler, Miller, Crehan, Babbit, & Pierce, 2003; Cass, Cates, Smith, & Jackson, 2003; Maccini & Hughes, 2000; Witzel, Mercer, & Miller, 2003).

A second additional strategy is *extended core*. Extended core was designed to provide students with extra time and support with the specific content being taught in the school district's curriculum. The intervention sessions began by the teacher stating the central focus of the lesson and recapping the material that was covered in the core curriculum and how the information would be extended or reviewed in the current lesson. Systematic teaching or reteaching of critical vocabulary related to the daily lesson was also included. Finally, students were encouraged to complete their regularly assigned homework as independent practice or reteaching pages provided in the program.

It is important to note that culturally responsive teaching doesn't necessarily negate the need for direct explicit instruction where appropriate. The instructional

strategies as noted above may all have their place in the learning of CLSD students who struggle in mathematics or who may have a math disability. In particular, peer assisted strategies are noted throughout the culturally responsive literature as well as the special education literature to be successful with CLSD students.

TEACHING ELEMENTARY ENGLISH LANGUAGE LEARNERS WHO ARE STRUGGLING IN MATHEMATICS

Supporting English Language Learners (ELL's) in today's schools is increasingly important since one out of every ten students in the U.S. is an English Language Learner (Kohler & Lazarín, 2007). Though about 79% of ELL's are of Hispanic origin (Kohler & Lazarín, 2007), these students represent over 400 different language backgrounds (Goldenberg, 2008). Schools are failing to teach mathematics to many English language learners. More than two thirds (71%) of English Language Learners scored below basic in mathematics (NCES, 2009a). Ell's have the task of learning a second language and learning mathematics simultaneously. Teachers are challenged with making math lessons comprehensible and making sure students have the language to understand instruction and express their grasp of math concepts. Though the research on mathematics and Ell's is scant, several main strategies emerge from extant literature. They are: to teach vocabulary, use word banks, visual aids, gestures, and demonstrations; relate math problems to prior knowledge and experiences; use manipulatives, drawings, and symbols; utilize the students first language as much as possible; work in cooperative groups; and give students time to respond.

Instructional strategies. Based on the literature for effective teaching of elementary English language learners who are struggling in mathematics, six major teaching strategies can be identified. They are: (a) teach vocabulary; (b) relate math problems to prior knowledge and experiences; (c) use manipulatives, drawings, and symbols; (d) use students first language; (e) work in cooperative groups; (f) give students time to respond.

***Teach vocabulary*.** Charts that contain key math vocabulary and phrases are helpful references for ELL's (Willig, Bresser, Melanese, Sphar, & Felux, 2010). Teachers can also use real objects during demonstrations to help the comprehension of Ell's such as marbles, buttons, patterned blocks, beans, and coupons. Students learn better when instruction proceeds from concrete to abstract (Furner, Yahya, & Duffy, 2005). There are also numerous gestures, visuals, manipulatives, and graphical representations that can support ELL's in the mathematics classrooms. Teachers can use these to clarify meaning while students can use them to express and develop understanding (Roberts, 2009). One idea put forth by Winsor (2007) is to use word squares. Students write the mathematical term in their own language on one side of a card, and the English word on the other side. Students then write the definition of the term in whichever language they are most comfortable with. In the lower right quadrant of the card, students would write the mathematical representation of the concept.

***Relate math problems to prior knowledge and experiences*.** Teachers need to work with students to understand their prior ways of participating in mathematics classrooms so that they can build on and understand these experiences (Moschkovich, 1999). Teachers also need to be aware that the context of the mathematics problems may be different than the children's experiences. For example, a problem using slope with the example of a ski slope may be unfamiliar to many ELL students (Roberts, 2009). Also, for example, if Chinese students are more familiar with an abacus, they should be encouraged to use it during calculations. By capitalizing on student's prior knowledge, teachers can build bridges between what students already know and new knowledge presented in the classroom (Freeman & Crawford, 2008; Furner, Yahya, & Duffy, 2005; Roberts, 2009; Gutiérrez, 2002).

***Use manipulatives, drawings, and symbols*.** Manipulatives, drawings and symbols give students ways to construct physical models of abstract mathematical ideas. They build students' confidence by giving them a means to test and confirm their reasoning and are useful in solving problems. The use of manipulatives provides teachers

a means to do further work on math concepts without the use of activity sheets. They help students learn math in an enjoyable way and in making connections between the concrete and abstract. Drawings and symbols help the student process auditory information before making a verbal response and can be used as evidence of student's understanding math concepts (Furner, Yahya, & Duffy, 2005; Lager, 2006; Willig et al., 2010).

Use student's first language. Students can use their first or home language in many ways in the mathematics classroom. For example, students may use their dominant language for labeling objects, justifying answers, and describing mathematical situations (Roberts, 2009). Using a student's first language can help the student make meaning out of a mathematical situation (Gutiérrez, 2002). Gutiérrez (2002) argues that students can use their first language to "process higher order thinking skills" (p. 1079). Allowing students to use their first language acknowledges that multilingualism is a resource that does not necessarily interfere with mathematics learning (Barwell, Barton, & Setati, 2007, Gutiérrez, 2002). Also allowing students to use their everyday colloquial language to present their mathematical ideas can help students build mathematical concepts. Teachers can then follow up student's informal language with the correct English mathematical terms so that students can use them in the future while associating them with their informal terminology (Gutiérrez, 2002; Roberts, 2009).

Work in cooperative groups. Cooperative learning has become an important instructional strategy in reformed mathematics classrooms. Campbell and Rowan (1997) advocate grouping students heterogeneously to promote language growth for students less proficient in English. This strategy gives ELL's the opportunity to hear the language of instruction in a more context-embedded manner (Faltis, 1993). Many students who are learning a second language are hesitant to speak out in front of the whole class. Smaller cooperative groups gives students greater opportunity to express their ideas and practice their English (Garrison, & Mora, 1999).

If possible, ELL's should be placed in small groups where at least one bilingual student can act as facilitator during activities. If there are many students who use the

same language in the classroom, the use of this language can best be facilitated in small groups. Teachers should understand that if the goal is to learn mathematics, there are times when the use of the first language will more effectively achieve this goal (Cirillo, Bruna, & Herbel-Eisenmann, 2010).

Give students time to respond. It is essential that teachers give all students, but especially English language learners, time to process questions and prepare a response. Teachers should speak slowly and use clear enunciation. Teachers can also reduce teacher talk, use a variety of words for the same idea, and place emphasis on new concepts or questions. After asking a question, wait for a few moments before calling on students to respond. It may also help to write questions or sentences on the board.

Culturally Responsive Response to Intervention

Much of the literature on students from CLSD backgrounds in special education has to do with reducing the disproportionate representation of these students in special education. Most of the blame for disproportionate representation has fallen on the discrepancy model of identification for disabilities. The discrepancy formula has also been called the "wait to fail" model because children had to wait until a large enough discrepancy developed between their academic achievement and their learning potential as measured by IQ tests. Due to the dissatisfaction with the discrepancy model, many states have been moving toward adopting a response to intervention (RTI) model. In this model, all children are given high quality evidence based instruction in the general education classroom. Children who do not achieve on a level comparable to their peers are provided with more intensive evidence based interventions. A popular RTI model has three steps or tiers. Tier one is universal instruction in the core curriculum. Tier two consists of instructional modifications for those having difficulties. Tier three is more individualized intensive instruction and often includes referral to special education (García & Ortiz, 2008; Harris-Murri, King, & Rostenberg, 2006).

Strengths and limitations of RTI for students from CLSD backgrounds. Current RTI models, however, have both strengths and limitations for students from CLSD backgrounds. The strengths are first, that analyzing how students perform in the core curriculum and adapting the curriculum for students who are not performing as expected along with providing high quality intervention for those with continuing problems, helps educators distinguish students with disabilities from those with difficulties due to other factors. Such factors may include the lack of access to quality instruction that is responsive to student needs and consistent with students' native languages, English proficiency, culture, race/ethnicity, learning style, social class, or gender (Linan-Thompson, Vaughn, Prater, T Cirino, 2006; Wilkinson et al., 2006). A second strength of the RTI model is that it necessitates general education taking responsibility for the education of all students, including those with disabilities and those who may be culturally diverse. Students with disabilities are not seen as the main responsibility of the special education teacher, and culturally and linguistically diverse students are not seen as the main responsibility of the ESL teacher. Rather, general education is responsible for delivering high quality core instruction to all students, providing evidence-based interventions for those who struggle, and promptly identifying those individuals with disabilities (Marston, et al., 2003). Third, the RTI model contains the possibility of intervening early as a student begins to have difficulty instead of waiting until a pattern of failure has been established (Garcia & Ortiz, 2008). Fourth, as stated above, the RTI process takes into consideration broad contextual factors which impact student achievement (Harris-Murri, King, & Rostenberg, 2006).

Critics of RTI point out several limitations. First, the almost exclusive focus of RTI on reading narrows the construct of LD to a reading disability (Mellard, et al. 2004). Second, when students do not respond to intervention, RTI data does not identify the underlying causes (Kvale, 2005). Third, standardized assessments are being replaced with standardized intervention protocols (Gerber, 2005). Fourth, scientifically based research on CLSD students, the very students RTI purports to benefit, is often not available

(Garcia & Ortiz, 2004; Harris-Murri, King, & Rostenberg, 2006; Klinger & Edwards, 2006; Ortiz, Wilkinson, Robertson-Courtney, & Kushner, 2006). Finally , the potential for inappropriate eligibility decisions are still present if RTI interventions are not culturally responsive (Harris-Murri, King, & Rostenberg, 2006.)

These limitations are particularly applicable to the discussion of cultural responsiveness in general education classrooms. They point out the need for educators to locate the source of learning difficulties not in the children themselves, but in the wider school and instructional context (Garcia & Ortiz, 2008). They further highlight the fact that student variables such as race/ethnicity, culture, language, and gender have often been left out of the research on RTI (Klinger & Edwards, 2006). Lastly they point out the need for classroom instruction on each level or tier to be culturally responsive.

.

CHAPTER III

Culturally responsive teaching (CRT) is recognized in the literature on effective schooling for students from culturally, linguistically, and socioeconomic diverse (CLSD) backgrounds as being a powerful tool in the hands of teachers for assisting both teachers and students to adjust to cultural and linguistic differences, thereby improving mathematics outcomes for CLSD students (Lipka, Sharp, Adams, & Sharp, 2007; Lipka, Hogan, Webster, Yanez, & Adams, 2005). However, several gaps can be identified in the literature on CRT. First, although there is a significant quantity of literature emerging on CRT, most of this literature has been conceptual in nature. Much less of this body of literature is focused on empirical studies that explore the implementation of CRT in the classrooms of practicing teachers. Second, most of the implementation research focuses on literacy instruction or areas other than math. Third, most of the research that exists in the implementation of CRT in mathematics focuses on classrooms made up of African American students, or Native Alaskan/Hawaiian students. There are very few empirical studies that focus on the implementation of CRT in math classrooms where students are predominantly Latino. Finally, the focus of the literature on implementing CRT in math is almost evenly divided between secondary or middle school students on one hand, and elementary school students on the other. I chose elementary school students because learning in elementary school lays the foundation for learning in middle and high school

(Carlisle & Flemming, 2003; Green & Cillessen, 2008; McCaslin, Burross, & Good, 2005).

The purpose of this research, then, was to help fill these gaps in the literature by exploring the implementation of CRT in elementary math classrooms where the Latino/a students, as a group, are viewed as being at risk of school failure. I was also interested in examining how teachers may implement CRT effectively as part of high quality Tier 1 instruction in a Response to Intervention (RTI) framework for all students including those who are struggling and/or have learning disabilities. Examining the practices and beliefs of successful teachers is important in creating profiles that can inform other teachers, school district personnel, and teacher preparation professionals. The following questions will guide this study:

1. What are the features of instruction utilized by elementary math teachers who are successful at teaching math to Latino/a students typically viewed as being at educational risk?
2. How are these features responsive to Latino/a students' cultural and linguistic backgrounds and personal life experiences?
3. How do teachers' instructional practices with Latino/a students correspond with the theoretical principles of culturally responsive teaching?

RESEARCH DESIGN

This qualitative, naturalistic inquiry explored the teaching practices of five elementary general education math teachers as they taught Latino/a students. It is an assumption of this research that the contexts surrounding the variables studied are as important to the outcome of this investigation as the variables themselves. Contexts surrounding the variables included ethnicity, language, how the teacher views his or her role, and how the teacher organizes students for instruction. The goal was to investigate the complexity of the mathematics classroom including culturally responsive teaching techniques and how these factors interacted with one another.

I chose to use collective case study (Stake, 1995) as the research methodology for this study for several reasons. First, each mathematics classroom made up a bounded system that defined each case. Five teachers were observed in their mathematics classrooms as well as interviewed, yielding five cases in the study. Second, case study allowed teachers and their classrooms to be embedded units of analysis and through interviewing teachers, and observing them working with the students in their classrooms, I gained an understanding of culturally responsive teaching. Third, case study was chosen because I wanted to cover contextual conditions mentioned previously because they were highly relevant to my topic. Lastly, case study is best suited for my research purpose which was to describe the CRT practices and beliefs of elementary math teachers.

RESEARCH AXIOMS

A paradigm may be viewed as a set of basic beliefs or axioms that represent a worldview that defines for its holder the nature of the world and the individual's place in it. The beliefs are basic in the sense that they must be accepted on faith. There is no way to prove or disprove them (Lincoln & Guba, 1985) . All paradigms are human constructions, that is, they are all inventions of the human mind and subject to human error. No construction is incontrovertibly right, advocates for any particular construction must rely on persuasiveness rather than proof in arguing their position (Lincoln & Guba, 1985). The paradigm underlying this research study is the constructivist or naturalistic paradigm. The naturalist inquirer operates on a different set of assumptions concerning the nature of reality, epistemology, and generalizability.

The purpose of naturalistic inquiry is not to develop a body of knowledge that is objective or generalizable in the traditional sense. Rather, its aim is to develop shared constructions that illuminate a particular context and to provide working hypotheses for the exploration of others (Erlandson, Harris, Skipper, & Allen, 1993). There are five axioms (Lincoln & Guba, 1985) about research in the constructivist paradigm that are central to this study and can be expressed as follows:

Axiom 1: There is no single perspective of reality. Realities are understood to be multiple socially and experientially based constructions and are dependent for their content on the individual persons or groups who hold the constructions. There are various perspectives of reality because what is seen is influenced by the act of observation and the characteristics of the observer. Because these realities cannot be understood apart from their contexts, the research interaction should take place with the research participants in context for fullest understanding. Reality for any individual is based, in part, on her or his gender, social class, culture, education, and other personal characteristics. In this research, each teacher was treated as an individual case. Profiles were created to reflect the unique perspective of the teacher about their teaching and their students. Interviews reflected the perspective of each teacher in his or her classroom.

Axiom 2: The inquirer and the object of inquiry interact to influence one another; the knower and the known are inseparable. The investigator and the object of investigation are assumed to be interactively linked so that the findings are literally created as the investigation proceeds. I recognize that the questions I asked teachers and students were influenced in part by how I believed they were likely to react to the questions and what I felt was important to ask given my own theoretical lens. Conversely, the teachers' responses were influenced in part by the questions I asked, their own perceptions and expectations about the research and their understandings of what was important related to my topic. I tried to be aware of this mutual influencing process and was willing to make changes if necessary. In order to be aware of the ways that I may have influenced the research, I kept a personal journal in which I recorded my perceptions and reactions to the teachers and the research.

Axiom 3: The purpose of research is to develop a body of knowledge about a specific individual or phenomenon. The teachers' practices in this research reflect their unique perceptions and beliefs based on their experiences. My goal is to provide the reader with "thick description" (Geertz, 1973) in which I document sufficient information

about the context in which the inquiry was carried out so that the readers of this research can make a determination of the goodness of fit to their own perspectives and situation.

Axiom 4: All entities shape one another simultaneously so that it is impossible to determine cause and effects. In other words, everything influences everything else in the here and now. Directionality in an interaction cannot be determined. It is the job of the researcher, then, to describe the relationship between and among variables. For example, there is an interrelationship between culture, language, race/ethnicity, social class, experience, education, and performance in both teachers' and students' school experiences. This understanding influenced the questions I asked of teachers. Example questions: What do you think has contributed to your success with students who are viewed as being "hard to reach" or students in at risk settings? What factors do you think influence how well students do in school?

Axiom 5: The inquirer brings his or her values to the research process. Values consist of perspectives, assumptions, cultural norms, individual norms, and theories that the researcher brings into play either implicitly or explicitly in making choices. In other words, research cannot be value free. In the past I have held deficit views of cultures different than mine. I need to always be aware of my perspective and thoughts in this area and remember what I have learned more recently about culture that has helped me form more positive views. Writing about this in my reflexive journal helped me stay aware of my biases and helped me concentrate on the positive. My passion for social justice is a value that influenced my research. I worked to stay focused on the teachers' perspectives rather than my own in conducting this research.

Assumptions and Researcher Role

***Assumptions*.** In addition to these axioms, two other assumptions about research guided this study. First, the researcher is the research instrument (Lincoln, & Guba, 1985), and second, qualitative research designs are emergent (Erlandson, Harris, Skipper, & Allen, 1993). The researcher is the instrument in qualitative research because first, it

would be virtually impossible to devise a non-human instrument with sufficient adaptability to adjust to the many realities that were encountered. Second, it is understood that all instruments interact with respondents but only the human instrument is capable of grasping and evaluating the meaning of the interactions. Finally, mutual shaping of events and factors can only be appreciated by a human. Qualitative research designs are emergent in that, even though the researcher goes into the research with as much design as he or she believes is faithful to the context and will help answer questions about it, the researcher allows the context and the respondents constructions of reality to influence the design and allow the design to emerge. I went into this research with a good idea of how I wanted to conduct the research; however, I looked for ways to improve the design even after the research began (Corbin & Strauss, 2008). For example, when the research began I wondered if eight observations were going to be adequate. After several observations were completed I determined that eight observations were going to be sufficient.

Researcher role. Erlandson et al. (1993) state that, in most instances in qualitative research, one of two roles is chosen by observers. They are either the participant-observer role or the observer-participant role. The participant-observer is more involved in the research group and his or her role of observer is subordinate to his or her participation in the group. The observer-participant, on the other hand, is more involved in the act of observing and the role of participant is subordinate to the role of observer. For this study, I took the role of observer-participant because I wanted my presence to have as little impact on the participants as possible. For example, I did not interact with the teacher or the students during observations. I sought to minimize my influence on classroom events by placing myself and my video camera as out of the way of the normal functioning of the classroom as possible. During interviews I sought to concentrate on teacher perceptions and constructions rather than interposing my own.

METHOD

Setting and Participant Selection

Because teachers of Latino/a students were the focus of my study, I chose a setting where Latino/a students would comprise the majority of students. School districts in the central Rio Grande Valley (RGV) of South Texas, which is subsumed in the Region One Education Service District, was chosen as the setting for this study because approximately 97% of students in Region One are Latino/a. Table 3.1 compares 2010 student demographics by state and region. The year 2010 was the most recent year at the time I began the selection process.

Table 3.1 Comparison of Student Demographics by State and Region

	Ethnicity			Economically Disadvantaged
State/Region	Latino	White	LEP	
Texas	49	33	17	59
Region One	97	2	37	86

Note. All figures are percentages of all students and are rounded to the nearest whole number.
LEP = Limited English Proficient; TAKS = Texas Assessment of Knowledge and Skills
All figures taken from the Region One performance/profile report, 2009-2010.
Economically disadvantaged is a term the TEA uses for students who receive free or reduced price lunch at school.

Table 3.2 Compares mathematics performance by grade level and ethnicity for Region One.

Table 3.2 TAKS Math passing rates by Grade Level and Ethnicity in Region One

Grade level	3		4		5	
Ethnicity	Hispanic	White	Hispanic	White	Hispanic	White
Mean math passing rates	86	93	88	95	83	92

Note. All figures are percentages of all students and are rounded to the nearest whole number.
Source: All figures taken from the Region One performance/profile report, 2009-2010.
TAKS[1] = Texas Assessment of Knowledge and Skills

PARTICIPANT SELECTION. Purposive sampling is a central aspect of the constructivist paradigm and was used to select participants for this study. The logic and power of purposeful sampling lies in selecting information rich cases for study in depth, "governed by emerging insights about what is relevant to the study" (Erlandson, Harris, Skipper, & Allen, 1993, p. 33). For this study, information rich cases were teachers who had a demonstrated record of successful math teaching with Latino/a students. For the purpose of this study, *successful teachers* were defined as those whose students had the highest math passing rates with at least 85% of students passing at or above *Basic* on the math portion of the Texas Assessment of Knowledge and Skills (TAKS). The TAKS is a standardized statewide achievement test administered at specified grade levels in elementary and secondary schools in Texas.

I was particularly interested in districts and schools with a minimum of 75% of students economically disadvantaged because these numbers approximate the national profile of Latino/a students. At the national level, about 90% are classified as

economically disadvantaged (NCES 2007-2008. These dates were the most current when I was selecting schools). At the state level, figures are somewhat lower, at 59% (see Table 3.1). Additionally, this approach would generate a more homogenous student population. A homogeneous student population will focus the study, reduce variation, simplify analysis (Erlandson et al., 1993), and increase the likelihood that the findings will be transferable to other teachers of Latino/a students in similar contexts. The following multi-level criteria guided purposeful identification and selection of teachers successful at teaching math to predominantly Latino students:

Table 3.3 District Profiles

District	Percent Economically Disadvantaged	Percent LEP	2008-2011 TAKS Math Passing Rates Averaged for Grades 3, 4 & 5
A	88	42	86
B	85	31	90
C	86	26	92
D	56	27	94
E	94	36	88
F	67	27	90
G	98	37	80
H	89	37	79
I	96	51	77
J	93	28	77

Note. LEP=limited English proficient. PSJA=Pharr San-Juan Alamo.
TAKS[1] =Texas Assessment of Knowledge and Skills.
All figures taken from Texas Education Agency Academic Excellence Indicator System 2007-2010, District Performance Reports.

Level 1—Districts: I began with 10 school districts that comprise the central RGV region. The central RGV is the most densely populated area of the RGV and includes most of the largest school districts. From this pool of 10 districts, I identified districts with:

1. A minimum of 75% of students classified by the state as "economically disadvantaged" (eligible for free or reduced-priced lunch), and
2. The highest math passing rates on the TAKS in either grades 3, 4, or 5 averaged over the years 2008-2011.

Four districts (A, B, C, & E) met both inclusion criteria. See table 3.3 for district profiles.

Level 2—Schools: Next, schools from the identified school districts, schools were chosen using a similar approach:

1. A minimum of 75% of students who were economically disadvantaged.
2. At least 85% of students passing the TAKS math in either grades 3, 4, or 5 averaged over 2008-2011.

See table 3.4 for school profiles. I began the selection of districts with district C. However, they declined the offer to participate so I moved on to district A. One school in district A accepted the invitation to participate. I then moved on to district B. One school in district B accepted the invitation to participate. District E also declined the offer to participate.

Level 3—Successful Teachers: I began by asking the principal of participating schools to identify general education teachers who met the criteria that follow. General education teachers of math were chosen as target participants because the vast majority of students are taught in general education. This includes increasing numbers of struggling students (i.e. Tiers 1 and 2 of a Response to Intervention (RTI) model) or students with disabilities being taught in general education settings. Teachers were invited to participate if they:

Table 3.4 School profiles ranked by scores on TAKS math

District	School	Percent Economically Disadvantaged	Percent LEP	2008-2011 TAKS Math Passing Rates for Grades		
				3	4	5
A	1	85	55	87	98	90
A	2	98	39	95	91	97
A	3	78	35	97	93	90
A	4	82	35	95	96	92
B	1	84	43	92	96	92
B	2	92	61	90	96	88
B	3	92	60	95	92	93
B	4	98	51	94	95	92

Note. All figures taken from Texas Education Agency Academic Excellence Indicator System 2007-2010 District Performance Reports. ED = economically disadvantaged, LEP = limited English proficient

1. Were 3rd, 4th, or 5th grade general education math teachers. These grades were chosen because students participate in state-mandated assessments at these grade levels.
2. Had taught math in their current grade level for at least three years. I wanted teachers who had taught math in their current grade level for at least three years because the focus of my study is on teachers with a track record of success with this population of students. I accepted teachers who may have taught at a different school so long as they had taught their current grade level for at least three years.
3. Provided math instruction in English. Selection of teachers who teach in English was important because I am a monolingual English speaker and therefore am not

qualified to observe in classrooms where Spanish is the language of instruction. I anticipated that even English-proficient students included some who had been exited from bilingual education/ESL, this population was of interest to me in terms of their language experiences and how the teacher worked with students with differing capabilities in English.

4. Had a minimum of 85% of students meeting basic on the math TAKS averaged over three years 2008-2011.

My first choice for teacher participants came from the four schools identified as having the highest passing rates in district A. One school in district A accepted my invitation to participate, school A1. Insufficient numbers of teachers are identified from district A so I next moved to district B and invited the four schools identified in table 3.4. One school from district B accepted my invitation to participate, school B2. I included some teachers at each grade level. If a teacher declined the invitation to participate, the teacher with the next highest TAKS passing rates was invited until five teachers were identified.

Obtaining Consent

All teachers who met my selection criteria were invited in person and in writing. Those who accepted the invitation were provided the consent form that contained details regarding their participation and their rights to confidentiality as required by the Internal Review Board (IRB) at the University of Texas at Austin. The five teachers who accepted the invitation and returned the signed consent form became research participants. Participants were advised that they were free to withdraw from the research at any time with no negative repercussions. Each participant was assigned a pseudonym of her or his choice to ensure confidentiality and to protect privacy and identity.

Because the classroom observations were videotaped (see data collection procedures), all students from each participating teacher's classroom received information in person and in writing of the details of their participation and their rights to student assent and parental consent as required by the IRB at the University of Texas at Austin. I went to each classroom and spoke to the students in person and invited the class

to participate. In addition I sent a letter home (in Spanish and in English) explaining the research to their parents and asking for permission for their child to participate in videotaped classroom sessions. I also asked all students to sign the student assent form which they did. All students were asked to return the student assent form and the parent consent form before classroom observations and videotaping were conducted . Students who did not return the assent/consent form for being video-taped were positioned in such a way as not to be seen by the camera. It was not necessary to assign pseudonyms to students as their participation was limited to being videotaped during classroom observations. Safeguards to protect the videotapes from being viewed by anyone but the researcher were put in place.

Measures to Ensure Privacy and Confidentiality

The privacy of teacher participants was protected by allowing them to control the time, length, place, and duration of the interviews and the time of the classroom observations. They controlled how much of their thinking about concepts and practices they wished to share. Participants were provided with copies of the transcripts of their interviews to review for accuracy and consistency with the intent of their disclosures. Participants were asked to provide a written statement confirming that they had the opportunity to review the transcripts and clarify remarks. Participants received a copy of finalized transcripts for their records. To protect confidentiality, pseudonyms for teachers were used in handwritten field notes and in computer stored transcriptions.

Confidentiality of the research data. Audiotapes, videotapes, and field notes were kept in a locked brief-case while in transit from the school site to the researchers' office. Audiotapes, videotapes, field notes, and transcripts were kept in storage bins in a locked office at all times while not in transit. Audiotapes and field notes were coded so no personally identifying information was visible on them. Pseudonyms only were used during word processing and in any material stored on the computer. I kept a master code sheet which was kept in a locked cabinet in a locked home office. The master code sheet was kept in a locked cabinet separate from consent forms and collected data which was

kept in storage bins inside a locked home office. The master code sheet was destroyed once all data was collected and interactions with subjects were complete. Audio and videotapes were only seen or heard by the investigator. Flash drives used for backing up data were kept in a locked cabinet in a locked office at the researcher's home. Audiotapes and videotapes will be destroyed immediately after the dissertation is completed and the committee has approved of the dissertation.

Procedures for Data Generation

Data collection occurred over a 20 week period between October 2012 and February 2013 until data saturation and prolonged engagement were achieved. Data were collected through videotaped observations and audiotaped interviews. In addition, field notes and a reflective journal served as secondary sources of data.

***Observations*.** Classroom observations were my primary data source. The purpose of observations was to document practices of successful teachers and then to determine how they correspond with the principles of culturally responsive teaching or how they relate to students' sociocultural and linguistic background experiences. Each teacher was observed in his or her math classes which were typically a block period of one hour a day. Therefore, each observation lasted for 60 minutes for each of the eight observations spread over a 12-20 week period. Consequently, each teacher was observed for a total of approximately eight hours.

Marshall and Rossman (1989), define observation as "the systematic description of events, behaviors, and artifacts in the social setting chosen for the study" (p. 71) Observational data represent a firsthand encounter with the data rather than a secondhand account that would be obtained in an interview (Mirriam, 1998). Observation allowed me to discover the here-and-now interworking of the math classroom environment and yielded much more information about their teaching practices than emerged in interviews. Thompson's (1992) writing summarized the research on teacher beliefs in regards to teacher's actions in the classroom. She pointed to a repeated finding that mathematics teachers' actions frequently bore no relation to their professed beliefs about

mathematics and mathematics teaching. Therefore, I looked for what teachers actually did and sought to understand why. The observations also generated questions and topics that were followed up in interviews. Observations were audio and videotaped and transcribed. Videotaping was essential because it would have been virtually impossible to capture the complex interactions occurring in the classroom with simply field notes and I wanted to be able to go over the day's observations again to be sure I included everything that occurred in transcripts and analysis.

I scheduled observations in consultation with teachers. Teachers were free to cancel observations if they so desired and make up sessions were scheduled. I was at the school site in district A for 20 weeks. I was at the school sight in district B for 12 weeks. Observations for some teachers ran from October through December 2012. Other teachers began observations in December 2012 and ran through February 2013.

***Interviews*.** In naturalistic studies such as this one, interviews take more of the form of a dialogue or an interaction. It is a "conversation with a purpose" (Dexter, 1970, p. 136). The purpose is to find out those things that cannot be observed, such as feelings, thoughts, or intentions. Nor can we go back and forth in time or observe the meanings the person attaches to what goes on in her or his world (Patton, 1990).

There were two main purposes for interviewing teachers. The first purpose was to gain insight into the characteristics of each teacher and his or her classroom. The content of the interviews included background information on the teacher, information on the teachers' professional backgrounds, his or her teaching style, beliefs about teaching, and perspective on why he or she has been successful in teaching math. The second purpose was to gain insight into the thinking of each teacher as he or she implemented specific strategies to teach his or her students. The content of the interview included reasons for selecting a given strategy, as well as why he or she took certain actions with particular students and with the class as a whole. Because I began analysis from the early stages of data collection, interviews gave me an opportunity to "member check" with teachers the patterns I saw arising from the data, and assured that my representations of his or her

thinking agreed with his or her intent. I was mainly interested in each teacher's thinking about using strategies with particular students and learning why that strategy was chiefly as it related to ability, SES, or language.

Dialogue in interviews can range from being structured to unstructured. In this case, I used a semi-structured format for all interviews. I considered semi-structured interviews as the most suitable format for interviews because I wanted to cover the same topics with each teacher yet leave the questions flexible to allow for interests of the teacher to be included. I sought to keep in mind two things when preparing for the semi-structured interviews. The first was to carefully craft questions to reflect the basic research questions and interests of the study; and the second was not to be overly bound or overly structured by those questions but to allow questions to naturally emerge over the course of the interview (Erlandson et al. 1993).

I conducted three interviews with each participating teacher. Each interview lasted about 45-60 minutes in duration for a total time of approximately three hours per participant.

The initial interview focused on gaining insight into the characteristics of teachers and students. The first few questions were focused on getting acquainted with the teacher and establishing rapport. The remainder of the interview focused on the characteristics of students and the teachers' teaching style and beliefs. Sample questions for the initial interview are in Appendix A.

The two follow up interviews provided the opportunity to investigate events that occurred during observation periods. The focus of these sessions was on clarifying what I saw and how I interpreted these events. Because the follow up interviews focused on what I observed during an observation of a particular teacher, the interview questions were somewhat different between teachers. Questions for the follow up interviews emerged as the observations proceeded. Follow up interviews were from 45 to 60 minutes each. The follow up interviews allowed me to "member check" with the participating

teachers about the patterns I saw arising from the data and to seek teacher input about those patterns. Sample follow up interview questions are in Appendix A.

Other sources of data. Other sources of data included field notes and a reflective journal. Field notes documenting my observations were taken during each observation. I used the field notes to record my thoughts as I observed. I also wrote down any questions that came to mind during the observation to be followed up in follow up interviews. I also utilized a reflective journal to add rigor to the inquiry as I was able to record my reactions, assumptions, expectations, and biases about the research process. I triangulated data through observations, initial interview, follow up interviews, and field notes

Data Analysis

All interviews and observations were audio-taped and transcribed. Observations were videotaped and prepared for analysis by creating a written transcription of vocal data. Vocal and action events that occurred together in the classroom were kept physically together for purposes of analysis. Data was analyzed by hand as I wanted to be able to physically manipulate the data.

I used constant comparison to analyze data as this approach allowed me to compare incidents, assertions, and events with prior ones. It also allows other comparisons to be made. As Strauss and Corbin (1990) noted, an actual event can be compared with theoretical dimensions. I manually coded all transcripts and documents by noting patterns and themes, arriving at comparisons and contrasts, and determining conceptual explanations of the data.

I began data analysis of interviews, observations and other data by identifying units of ideas, labeling them, aggregating similar units under broader categories, and then organizing categories so they could be reviewed for themes. All data were analyzed in the creation of categories and themes. I did some preliminary analysis from almost the beginning of data collection as this informed topics and questions for subsequent interviews and I wanted to hear teachers' ideas on the preliminary categories and themes I saw emerging. Emergent theme analysis (Erlandson et al., 1993) was employed and

summaries of the themes were discussed with teachers. This member checking was used to ensure credibility and confirmability of the data. I checked for agreement or disagreement with my emerging themes.

I constructed a case study by organizing and analyzing the raw data into a case record for each participant teacher. All information from each classroom or case was kept in a separate bin with the teachers' pseudonym attached to it. All information included audio tapes, transcriptions from audio-tapes, observation videotapes, transcriptions from videotapes, field notes, journal entries and the products of analysis went into the bin for that case. I then created a Case Record which included all pertinent information gathered from all the interviews, observations, field notes and journal entries arranged thematically. Developing themes or categories was identified through the process of emergent categories destination (Erlandson et al. 1993). I began by reading the first unit of data and assigning it a label. I then read the second unit. If it's content had the same general feeling as the first unit, it was added to the same pile as the first so as to categorize them into sets. If not, it was set aside in the second category and assigned a tentative label. I proceeded in this fashion until all units were assigned to categories. All data sources were analyzed in this manner. I developed a descriptive title for each category. These served as decision rules for inclusion or exclusion from the various categories for each piece of data. To conclude I wrote a descriptive narrative about each case. I consulted with my participating teachers and asked them to review my interpretations and constructions for accuracy. Once the case studies were complete, I used cross case analysis in answering research questions two and three to look for recurring patterns and themes. Cross case analysis was built into categories or themes that conceptualized the data for all five cases.

Simple examples of the analysis I did come from teachers' case studies. An example of three of the units that were aggregated into the category *of reviewing previously learned concepts* and later conceptualized under the theme *making instruction comprehensible.*

1. Eva reviewed place value with her students. She passed out small paper jerseys that had place values on them up to the 100 billions place. Students put on their jerseys and arranged themselves in the correct order according to their place value without talking. They did the activity twice to make sure everyone had a chance to participate.

2. Eva reviewed what they had learned the previous week working with prime or composite numbers. She said: "Can anyone give me the definitions of prime or composite numbers? What is the definition for a prime number?" A student replied: "It is a number with only two factors, one and itself." Eva: "What is the definition of a composite number?" Student: "A number with three or more factors."

3. Eva: "First, I want to talk about the division you have already covered." She wrote 78 divided by 3 on the board. She asked the students to use the vocabulary words to tell her what the 78 and the 3 were called. "You have covered in fourth grade a two digit dividend by a one digit divisor…in the fifth grade we're going to add a digit to the divisor and the dividend as well."

Another category that was subsumed under the theme *making instruction comprehensible* was *using Spanish.*

1. Miguel used the Spanish language to teach math concepts. He wrote *centa* on the board and said:

> *Centa* refers to 100. Centavo comes from the Latin. Spanish comes from the Latin. Cents; it takes 100 cents to make a dollar and a century is 100 years. *Cien* means 100 in Spanish. *Centi* means 1/100. These are your units. Centimeters and meters. One centimeter equals 10 millimeters. One meter equals 100 centimeters. One meter is about three inches more than a yard. *Centi* and *centa* mean something different based on the i and the a. Like niño and niña. Totally different based on the *o* and the *a*. Centa is 100/1. One meter equals 100 centimeters and one millimeter equals $1/10^{th}$ of a centimeter.

2. Eva also used the Spanish language with her ELL students. She occasionally translated a vocabulary word into Spanish even though her instruction was in English.

A final category in the theme *making learning relevant* was *using students' background knowledge and personal life experience.*

1. Mary used iPods for a lesson on possible outcomes. The iPods were something familiar from the students' backgrounds and something that they liked. She said the previous day they had worked on the tree diagram and the numbers solution. She said that day they were going to do the table and the organized list. She wrote down "iPods" in the center of a piece of paper under the document reader. Under "iPods" she wrote the colors black, red, or silver. She wrote "case" beside "iPods" and wrote the colors orange, blue, and green. She then led the class in making a table and an organized list of the possible outcomes.
2. The use of food from students' backgrounds served as a bridge to new concepts. In a lesson on what Miguel called combinations, he said they were going to provide breakfast tacos to the faculty in the morning. He said they were going to use four ingredients: egg, chorizo, potatoes, and bacon. They made each taco with two ingredients. On another occasion when the lesson was also on combinations Miguel wrote four types of food on the board. They were *meat, vegetable, drink,* and *desert*. One of the deserts was *tres leches,* a type of traditional Mexican cake. In a final example, Miguel put 11 types of food on the board and the students were to put the food into categories and solve for the total number or combinations.

Establishing Trustworthiness

Research should include a process for developing sound inquiry. Lincoln and Guba (1985) present criteria for establishing trustworthiness in qualitative research. These criteria are credibility, transferability, dependability, and confirmability.

Credibility. Credibility refers to whether the reader of the research finds the research believable. Techniques that increase the probability that credible findings will be produced include prolonged engagement, persistent observation, triangulation, peer debriefing member checks, and negative case analysis.

First, prolonged engagement is the investment of sufficient time to achieve certain purposes. It was imperative that I, the researcher, spent enough time to be oriented to the situation, "soaking in the culture through his or her pores," (Lincoln & Guba, 1985, p. 302) to be certain that the context of each teacher's classroom and school are thoroughly understood; to be able to detect distortion that might otherwise creep in, and to have opportunities to build trust. I spent 12-20 weeks at the school sites interacting with teachers to ensure prolonged engagement.

Second, through persistent observation I identified those characteristics and elements in the situation that were most relevant to the problem or issue being pursued and focused on them in detail. Persistent observation also helped me to avoid coming to closure too soon; that is, coming to a conclusion about a situation without sufficient observation time to identify relevant issues. I observed teachers for 8 hours, conduced 2 hours of follow up interviews and a 1 hour initial interview for each teacher.

Third, triangulation involves gathering data in multiple ways to get a more comprehensive perspective of the data. I triangulated data through using different methods of gathering data and different sources of data. Different methods of data collection will be audio and video tapes as well as field notes. Different sources of data will include teacher interviews and classroom observations. Teacher interviews allowed me to gather data on teachers' perceptions, beliefs, and expectations. Classroom observations allowed me to gather data on what teachers actually did in their classrooms.

Fourth, peer-debriefing served to keep me "honest" by eliciting searching questions from experienced protagonists doing their best to play the devil's advocate. In this way, my biases were probed, meanings explored, and the basis for interpretation clarified (p. 308). I attended three dissertation group meetings consisting of myself and

two other multicultural special education doctoral students during the writing process. These fellow group members served as my peer de-briefers.

Fifth, credibility can best be established by ensuring that the research is plausible to the participants in the study through member checks. Each teacher reviewed her profile and provided feedback on my interpretations of the data. Feedback from teachers indicated that my constructions of the data were agreeable to teachers. Lastly, negative case analysis adds to credibility by addressing and considering alternative interpretations of the data, particularly pieces of data that would refute the researcher's interpretation (Erlandson et al., 1993). During data collection and analysis, I searched for elements of the data that did not appear to support patterns I saw emerging from the data. If, through probing I determined that an alternative interpretation had substance, I would have worked with disagreeing participant(s) to develop narrative that provided an alternative interpretation. However, no disconfirming evidence was found.

Transferability. The naturalist researcher cannot specify the external validity of an inquiry; he or she can provide only the thick description possible to enable someone interested in making a transfer to reach a conclusion about whether the transfer contemplated is a possibility (p. 316). It was my intent to provide the widest possible range of information for inclusion in the thick description to make transferability judgments possible on the part of potential appliers. Thick description may include the classroom context with a description of teachers and their genders, ethnicities, SES, language, and other characteristics. I used purposeful sampling procedures and I compared the findings of this research to the findings of previous research The naturalist researcher cannot specify the external validity of an inquiry; he or she can provide only the thick description possible to enable someone interested in making a transfer to reach a conclusion about whether the transfer contemplated is a possibility (p. 316). It was my intent to provide the widest possible range of information for inclusion in the thick description to make transferability judgments possible on the part of potential appliers. Thick description may include the classroom context with a description of teachers and

their genders, ethnicities, SES, language, and other characteristics. I used purposeful sampling procedures and I compared the findings of this research to the findings of previous research.

Dependability. In a dependability audit, both the process and the product of the inquiry are examined. The process of inquiry was under constant review by my dissertation supervisor. At one point in the analysis I went back to re-evaluate some of my data. I reviewed and reconfigured some of the data by re-examining my codes for culture and background experience. I subsumed culture under background experience as it was more closely aligned to that concept. To examine the product of inquiry, peer reviewers were asked to review and compare the themes, findings, and recommendations they found in the data with the themes, recommendations and findings I found and attest that they were supported by the data.

Confirmability. The confirmability audit is similar to the dependability audit. It is said that there can be no confirmability without dependability. To establish one helps establish the other. An inquiry audit depends on the keeping of records stemming from the inquiry. Several types of records will be kept available for a confirmability audit. They are: raw data, data reduction and analysis products, data reconstruction and synthesis products, and process notes (p. 320). In addition to these records, I kept two journals throughout this study. They were a log of day-to-day activities recording what I did with whom and when and a personal, reflective log, recording my own perceptions, biases, and feelings about the study, the participants, and the topic. (Lincoln & Guba, 1985). Member checking also helped establish the confirmability of the study.

UTILITY OF THE STUDY

This study was an instrumental case study and explored the culturally responsive teaching of five successful elementary math teachers. Descriptions of their teaching practices and beliefs about teaching were documented. Data collection consisted of observations, interviews, and field notes.

The results of this study are most relevant to mathematics teachers in grade 3, 4 , and 5 with Latino/a students who speak English as a second language. Other grades or groups of CLSD students are not represented and caution should be followed in applying the results of this study to them. Additionally, the data describe only a small number of teachers successful with Latino students. Therefore, the findings of this study may not apply to all successful math teachers of Latino students. Finally, due to the homogeneity of the adult population and student body in the Rio Grande Valley, the results of this study may be most applicable to successful math teachers in the Rio Grande Valley of South Texas. However, it was my intent to offer enough "thick description" to make the study transferable to contexts that are judged by consumers of the research to be similar to their own.

This study has the potential to benefit teachers, teacher educators, general education and special education in a number of ways. First, pre-service and in-service teachers may benefit from having concrete examples of successful teaching in mathematics that may assist them in implementing successful teaching in their own classrooms. Second, teacher educators may benefit from these concrete examples as they seek to train future teachers in successful teaching in mathematics. General education educators may benefit from having a description of how successful mathematics teachers teach as part of their strategies for success for all students, i.e. effective tier one instruction. Special educators may benefit from descriptions of inclusive math instruction that is effective with students with learning disabilities. These benefits are important in terms of bridging the cultural gap that can occur between teachers and students from CLSD backgrounds and in creating a climate of equity and opportunity for minority students in learning mathematics.

CHAPTER IV

This study concerned the teaching practices of five teachers of Latino/a students in their mathematics classrooms. It was my goal to depict the culturally responsive teaching characteristics of these teachers. In this chapter I present individual teacher

profiles based on interview and observation data that depict their thinking about their instruction as well as approaches that characterize their teaching practices. This section is told mostly in their own words. Next I present a cross case analysis to reveal patterns or themes that they shared. The final section entails a discussion of how teachers' practices are responsive to students' cultural and linguistic backgrounds and the theoretical principles of culturally responsive teaching as they corresponded to the teachers' practices.

EVA

Personal and Professional Background information

Eva is a fifth grade teacher of mathematics at Ochoa Elementary School (pseudonym). She has been teaching for six years at this school and has taught all sections of fifth grade math all these years. Eva has lived in the Rio Grande Valley of South Texas all her life. She graduated from Rodriguez High School (pseudonym) in a city close to the Mexican border. Eva identifies as a Hispanic woman and reads, writes, and speaks both Spanish and English. She said that growing up her family was "socially and economically disadvantaged." Her mother was a single mother and worked as a custodian at her school.

Eva received her bachelors degree in business administration from a local university. She completed an alternative certification program and received a generalist teaching certificate for grades four through eight. Eva shared that at first she really wanted to major in business at the university because all her courses in high school were business electives. Once she completed her degree she tried an internship at a major retail chain. However, she decided that was not what she wanted to do. She began tutoring and that's when she realized she could become a teacher. When she came to interview at her current school for a teaching position, the principal indicated that they had a math opening. Because math had always been her favorite subject, she "figured that it was

destiny; she was supposed to be there." Eva reported that she received quite a bit of math instruction in her business classes, and that math was her favorite subject.

Perceived effectiveness of pre-service and in-service training. Eva indicated that her pre-service training did little to prepare her to work with different groups of students such as students with gifts and talents (GT), those with learning disabilities (LD), and those from lower socio economic status (SES). The alternative certification program didn't provide much to prepare her for GT, LD, or low SES students. In fact, Eva shared that during her first year she saw several bright students and thought they should be GT so she nominated half of her class for the GT program. But, she adds, through the years she has learned to spot the difference between the "book smart" student and a very gifted child. Through observation and experience she has since been able to differentiate and accommodate to those children. Her school district offers training for teachers of GT students about once a year. However, they have very few students identified as GT on her school campus. Out of about 80 students in fifth grade, three are identified as GT. The school district has created magnet school programs that are for GT students and any student who qualifies for the GT program may attend one of those schools. Most parents opt to do so.

Eva reported that there are about six students with LD in the entire fifth grade although she said there were none in the sessions I observed. Her pre-service training did little to prepare her to teach this population but she said that the district does offer some in-service training on working with the lowest achievers including those with LD. However, most of the in-service training focuses on teaching the average student. For students with LD, the teachers try to work closely with their special education teacher, a resource teacher.

Teaching students who come from low income backgrounds is another area that Eva said was not adequately addressed in pre-service or in in-service training. Over the years, through experience, she has learned how to better approach students from low income backgrounds. Eva noted that many of her students come from homes where the

family is struggling financially and that the students at this age are aware of those struggles. She affirmed that "not only do students have their learning on their minds, but their struggles from home as well."

***Eva's current students*.** Eva teaches very few students from ethnic backgrounds other than Hispanic. She stated that about 1% of her students are non-Hispanic White. She observed that it is a struggle for them because they know that they are in the numerical minority but she tries to reassure them that they are being treated as any other student. But she said the students get the feeling that they are being targeted when they misbehave. She tells them that any student who does certain things would receive the same punishment. So she has to reassure them that ethnicity is not the issue. As for students who are English language learners (ELL's), Eva reported that many of the ELL students have been exited from the program by the time they are in fifth grade. During the year of the study she only had one ELL student in who was receiving special language services in her room. However, English is the formal language of instruction.

When asked about the performance level of students in her classroom when they enter fifth grade in the fall, Eva indicated that the majority of them are at grade level in math. A few of the students are slightly below grade level but rarely above. However, students often begin the year significantly below in reading.

Views on Teaching.

I asked Eva about her views on teaching. I specifically wanted to know her philosophy of teaching, what she likes best and least about teaching, some of the positive and negative interactions she has had with students, and some of the challenges she faces.

***Philosophy of teaching*.** Eva's philosophy of teaching is that you cannot treat every child the same. She shared:

> It's not a cookie cutter type of relationship with every child. Some need the tough love because you need to get on top of them otherwise they are going to let lose a little bit and they're going to slack off. But with some, you can't give [sic] that approach because they will shut down on you.

So, she said that she has had students to whom she has had to say: “OK fine, you’re the boss.” But at the end of the year they were commended for their performance. So “you can’t treat each child the same. You have to get to know the student and alter your behavior with them based on just how they react.”

According to Eva, a successful teacher isn’t necessarily one whose students pass the state achievement test who have done well in years past, but rather one who has students pass who have never passed before. Getting students to improve over where they were the previous year would be considered success, not only academically, “but getting a student to flourish in their personality, breaking down their shell a little bit.” Every year the fifth grade teachers have a student who may have been labeled as a troublemaker who they try to change by the end of the year. They like to say: “he was the troublemaker…but we changed him this year…we helped him find himself.”

Eva related that a successful teacher is also one who is willing to differentiate instruction. “Because if you just have one lesson plan for your entire grade level it’s not going to work because there’s different styles of learning and different levels of ability.” Teachers must also be knowledgeable in their subjects. Eva feels knowledgeable about her subject. She said that she can give students several strategies to answer a problem and she wouldn’t be able to do that if she were teaching science for example.

Eva conveyed that one thing a successful teacher does is to let students know when there are similarities between teachers and students. For example, Eva tells her students that her background is similar to theirs. Her mother worked as a custodian, she was a janitor when Eva was growing up. She tells them that her parents did not attend college and that she has had to work hard to earn good grades to be able to go to college. Eva believes that students need to know that their teachers came from a background similar to theirs. They need to know “oh, you were something like me, and I can grow up to be like you.”

What Eva likes best and least about teaching. What Eva likes best about teaching is when she is able to impact at least one child. She said: “When at the end of the year,

even our toughest fifth graders are crying because they don't want to leave us…and they are the big, tough kids…that just makes it so rewarding." She recounted that she had one student who failed the first administration of the math and reading state achievement test. He was in their intervention group and he was just having a bad day. And Eva told him:

> Come on, we have just two more days of intervention before we take the achievement test. And he says: "I don't want to pass." And I said why? You don't need to be scared about going to middle school, I'm sure you have friends who can protect you. And he said: "I'm not scared." And I said: then what is it? And he looks down and he says: "I don't want to leave you guys." It was very touching. He was like: "I'm ready to fail if I can stay here with you."

Eva found it very rewarding to hear him say that. These moments make teaching worthwhile for her. She reported that this student did take the re-test and gave 110 percent. He passed the math test with the highest grade of all students who took the re-test.

What Eva likes least about teaching is the stress of the state achievement test. She stated that: "If we could just get rid of the achievement test it would make a world of difference. It is so overwhelming; the stress on the kids, the stress on the teachers." Eva conveyed that the fifth grade teachers had a tough group of kids this year academically. In her seven years, this had been the toughest group yet. She added:

> They did a little bit better in math than in the other two areas but we have never had a group like this where it didn't go well to say the least. So much pressure is on the teachers and students.

The teachers do not like having to tell some of the students that they were unsuccessful. One student who had skipped fourth grade and who had struggled a great deal in fifth had to be told that he was unsuccessful. Eva recalled that he cried hard. It " broke her heart" to have to tell him he was unsuccessful and that he was going to have to take the test again.

Positive and negative interactions. Eva recalled both positive and negative interactions she has had with students during the year. As an example of a positive interaction she described the change she has seen this year in one student who had been

defiant in the past. She explained that one thing the teachers stress in fifth grade is that "you are the oldest group in the school, so let's be respectful." This student had been sent to an alternative placement (AP) program the previous year because he was perceived as being very disrespectful. However, contrary to expectations, he had been very respectful the current year. Eva said that she has spoken with him constantly about having respect for each other. She told him: "I respect you, you respect me, and in turn you respect everyone else around you." Eva reported that his mother did say she had seen a big difference in him this year, and they have had a pretty successful year with him at school.

> He's a lot more respectful and he's happy to come to school and things of that sort. We're not playing the game of he yells at me and I yell back at him. It's OK, it's a clean slate this year. You are a lot more mature so let's be respectful of each other.

An example of a negative interaction involved a student who struggled in math. Eva said she tried to get him to come in for tutoring. She had spoken to his mother about the problem but the mother said that she could not get him to do the work at home. Eva said the mother flatly told them that there was nothing she could do. Eva commented:

> So right there, if we don't have the parent's support then there is not much we can do at our end if the parent is saying in front of the child that there is not much they can do at home, that "I can't make him do it at home." The parental support is very important. So if she is telling us in front of him that "I can't do anything about it," we can just try what we can here at school but other than that it makes it very hard. And of course he was not successful. He did get the lowest grade on the achievement test in every single subject area. He did take the re-test, so we'll see how he does.

***Challenges*.** Eva indicated that her greatest challenge in teaching is trying to reach out to students who are "dealing with al lot from home." She explained that some students cannot focus on the task at hand whereas others have a negative attitude because of something that may have happened at home. Her greatest challenges are dealing with the students' home and finding a way to help them. "But" she says, "if they come in hungry, or if they have gone through something dramatic at home I feel helpless to help them."

Eva believes that her role as a teacher goes beyond teaching the concepts, to being a role model. She feels that most students look up to the teachers, and the teachers should make sure that their behavior is appropriate, whether it is in the classroom or in the hallways. Because Eva believes that many of the parents are "uneducated," she feels the responsibility "to be someone that students can look up to; to be someone that the students can look forward to being like in their education."

Views Concerning Students and Parents

Eva believes that an excellent student is one who is well rounded academically as well as personally. An academically well rounded student is one who does well not only in math, but in reading and science as well. She also linked being well-rounded with the ability to interact well with others. "It's not just about books, but socially as well." A well-rounded student participates in class as well as interacts well with other students. Eva noted that students who participate in class tend to do better than the ones who remain mostly silent. She said she faces this mostly with some of the girls in her class. They do not feel confident about themselves and comfortable among their peers. They are embarrassed to ask questions during class. Eva deals with this by having them partner with a more vocal student during class and sharing what they did in class that day.

For Eva, another characteristic of a successful student is having the desire to improve, the student may not necessarily be the "A" student, but wants to learn more. Eva related that one of her current students skipped fourth grade and has struggled this year in fifth. But, she said she could see a passion in him, he is not satisfied with being where he is, he wants to improve. He volunteers to stay for tutoring. Eva reported that she has seen great improvement since this student has participated in small group. He needed the individual intervention.

What students need most to be successful. Eva shared that one of the things students need to learn most is that life is not always fair. In school, teachers make great effort to assure that everyone in the classroom is treated fairly. But, she said, that's not going to be the case in real life. She wants students to be ready for situations when life

may not treat them fairly. She tells her students: “Just be ready for the times when someone is not going to treat you fairly and how to respond to that.” Two other attributes that she sees as important for students to demonstrate are learning independence and being responsible. Eva pointed out that often when students forget their homework, they want to call their parents and have them bring it to the school. Eva said that they let them do so, but they should be learning to be responsible because their parents are not always going to be able to do so. “As 10-year olds, they are getting out of the stage where mommy and daddy do everything for me.” So in fifth grade, one of the things teachers emphasize to their students is to be more independent. For example, they do implement class rotations to get students used to middle school where they will need be expected to be more independent and responsible.

When asked what she believed were the greatest needs of her students both academically and personally Eva responded that parental support would fall into both. She pointed out that many parents work two jobs and they get home late so they are not able to help their children with their homework very much. They are not always able to give their children the attention that they need. Because of that, Eva noted that at times this causes the students to act out at school. Eva related the story of one of her students who was not doing very well; who was not doing his homework. She called a parent conference and the mother said: “I’m starting to work more hours. He is used to me giving him a lot of attention so now he’s trying to rebel against me by not doing his homework.” So, Eva said, the parent can have a negative impact on both.

***Working with parents*.** I asked Eva what factors she thought influenced how well students do in school. Again she again emphasized parental support. She believes that some of her have a great deal of potential but their parents don’t emphasize that school is important. Eva said: “School isn’t important to them so they don’t instill that in their children.” Eva acknowledged however that there is a wide range of parental responses to school. Some families are very involved, want to know how their children did on a test, ask what they can do at home to enhance their education, and what websites they can

work on with their child. Parents at the other end of the spectrum that do not respond to phone calls from the school and do not return forms sent home for a signature. Although parents do not come into the classroom, quite a few parents participate in the schools' parent volunteer program and are at school regularly or accompany students on field trips. Eva reported that she tries to maintain constant communication with the parents. She noted that several parents have her phone number and they will call or text her with questions. Eva also keeps her parents informed about the student's grades by sending home their weekly test with their grade for the parent's signatures. Doing this assures that they will not be surprised by their child's report card.

Eva attributed the students' lack of educational progress to the parents mostly because they are poor. I asked her what factors she considers when she thinks about the cultural background of her students. She replied:

> A lot of them, their income. Their financial situation at home. They're at an older age now so they know what's going on at home, they know when there are struggles at home so they come to school and that's what they worry about. So definitely their financial issues.

Eva also considers the parents marital situation, whether they are divorced or going through a separation. She said that the students are old enough to be aware of these circumstances. "So it's just their financial situation and their family situation a lot of times." Some students tell her: "I live with my aunts and my cousins and the whole family lives in one small house together and I have to sleep on the floor and I couldn't sleep because my cousins were up all night." "So," she concludes, "it all goes back to their family situation." In a similar vein, Eva said that at times students tell her they do not have enough food in the refrigerator or they have to wear unwashed clothes because their parents cannot afford to wash them. She believes that coming to school with these matters on their minds has a considerable effect on their learning. She believes that one of their "biggest issues" is that they come to school with their family problems in their heads. Consequently, one of her greatest challenges is to keep student's minds focused, which requires her to distract them from what is going on at home. "So the performing,

the doing things out of the normal, the small rewards, things they don't normally get at home." She keeps this in mind when planning her lessons.

Am I going to be able to get them so into the lesson that they are going to forget everything that is going on at home? I'd say it's 90% of our students that have so many issues at home that they have difficulty focusing. My biggest thing is, am I going to distract them enough for them to forget all their problems. Hopefully that's what I am able to accomplish.

A Typical Mathematics Lesson in Eva's Classroom.

In the following section I describe the features of math instruction Eva utilized in her classroom. I begin with the classroom context of typical day I observed in Eva's math classroom. I then go on to advance the aspects of her math instruction that she used on a regular basis. Eva used a wide variety of strategies to teach math to her students.

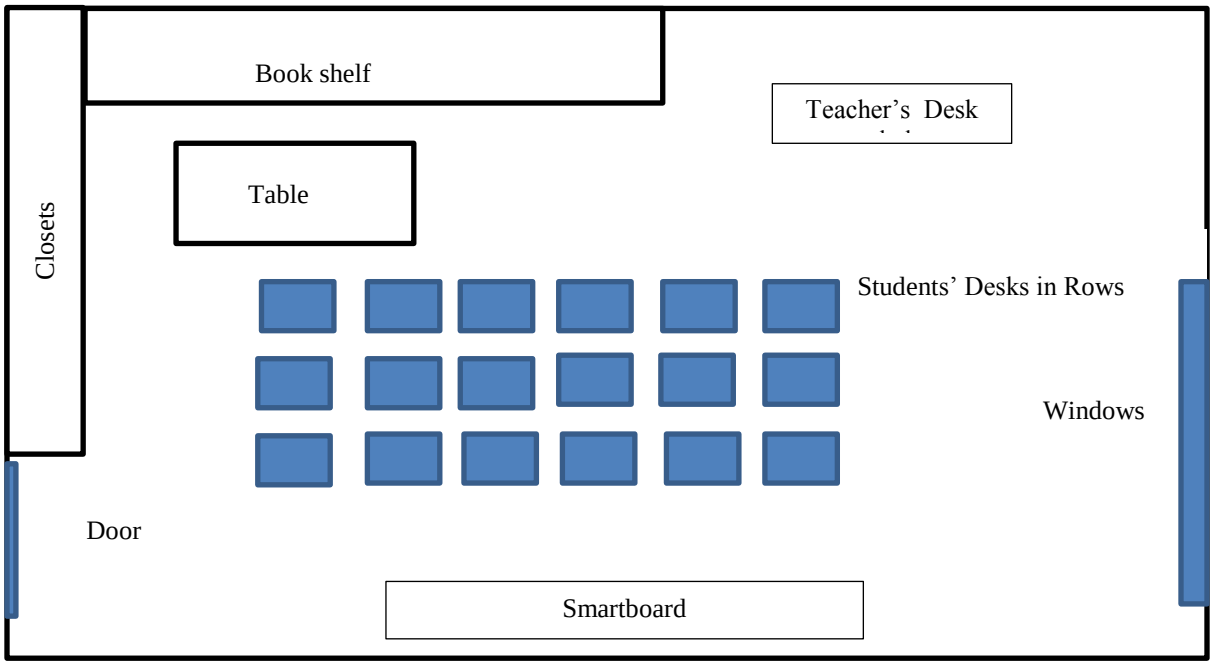


Figure 1. Eva's Classroom

Eva's classroom. As I entered the room the students were already at their desks quietly waiting for class to start (see Figure 1 for a diagram of Eva's classroom). Standing near the door, along the wall behind me and to my left are two closet. A table stacked high with books and papers sits in front of the closets and adjacent to a bookshelf. The back wall is taken up in part with a book shelf that holds students' math books. The books don't go home, they are used only in class. Continuing down the back wall is Eva's desk with a stand beside it on which the document reader rests. Her desk holds her computer and along with other papers and books. High on the far wall in front of me are a few windows covered by curtains. To my right is the front of the classroom with the Smart-board screen as a central apparatus. There are two bulletin boards on either end of a white dry erase board that is covered by the smart board screen. One bulletin board features students who achieved All Star status in math for the current six weeks and the other holds calendars, notices, and weekly vocabulary words. Math All Stars are students who have earned 100% on two math tests during the six week period. The student's desks are arranged in the center of the room in rows. Eva walks to the front of the class and class begins.

I observed Eva on eight separate occasions. The following observation was chosen because it is representative of what I observed across all lessons. The topic of the lesson was on parallel, perpendicular, and intersecting lines. Eva directed the students to write the vocabulary words in their journals. She used letters from the vocabulary words as visual aids to help the students remember what each one stood for.

Eva:	The first word we have is *parallel*. Can someone give me the definition of the word *parallel*?
Student:	Two lines that never meet."
Eva:	"Very good, two lines that never meet. What part of the word shows us the two lines?
Student:	The two *l*'s. (Eva circled the two l's in the word parallel)

Eva: Now let's talk about intersecting lines. What are intersecting lines?

Student: Two lines that cross each other's path.

Eva: What letter in the word intersecting is an illustration of what the definition means?

Student: The '*t*'.

Eva: Very good. The next word is perpendicular. What letter in the word reminds us of what perpendicular means?

Student: Capital '*L*,' perpendicuLar.

Eva: And what is the definition of the word perpendicular?

Student: Two lines that are at right angles to each other.

Eva then had the students use motions to display what the vocabulary words meant. She said: "I want us to show with our hands these different lines." She demonstrated parallel lines by holding her two arms parallel. The students copied her. Eva then demonstrated intersecting lines by crossing her arms. The students did the same. Finally, Eva demonstrated perpendicular lines with her arms with the students copying her.

Next Eva had the students play "a little game of 'Simon says'" with the three vocabulary words. She had them stand up and push in their chairs and said: "I'm going to call out *parallel*, *perpendicular*, or *intersecting*. You must show me with your hands. You must also wait to hear 'Simon says' before you do it. Ready? Parallel." This brought a peal of laughter from the students as several responded even though the teacher did not say "Simon says." Eva and the students continued to play for several more minutes. After the game was over, Eva said: "We're going to make a foldable to show the three vocabulary words." She passed out sheets of red construction paper saying "I want you to fold it hot dog style, which is vertically." She had the students fold the paper so that there were six squares when the sheet was opened up. In the top left square they wrote the word *parallel*. She had them circle the two l's in the word parallel. In the middle top

square they wrote the word *perpendicular* with a capitol "L." In the top right square they wrote the word *intersecting* and circled the "t." Eva next passed out six straws per person. She drew examples of parallel lines on the white board. She directed the students to glue two of the straws under the word *parallel* in the first square on their construction paper. She then drew some examples of perpendicular lines on the board and directed the students to glue two straws showing perpendicular lines under the word *perpendicular*. Finally, she drew some examples of intersecting lines on the board and students glued their straws in the appropriate place on their papers.

Eva connected the material they were learning to real world situations, saying:

> There is a purpose for us to be learning about lines. It's not enough for us to say in the classroom, OK, that's perpendicular, that's parallel. A lot of people use these vocabulary words when they are giving directions. For example, I can say our school is near the intersection of 9th and Dove. Or we can say that Cesar Chavez is parallel with Alamo Road.

Eva continued the lesson by distributing a handout with three copies of a street map. She had the students cut out the maps and glue one under each vocabulary word and straws on their construction paper. She then had students find examples of the three vocabulary words on their maps.

Eva:	Raise your hand if you can find two streets that are parallel to each other."
Student:	Exchange Place and Wall Street.
Eva:	Very good. Under the perpendicular section I want us to highlight the word Broadway. Which street is perpendicular to Broadway? It does not intersect Broadway but it is perpendicular to it.
Student:	Wall Street."
Eva:	Very good. It makes a 90 degree angle to Broadway. Let's look at our third map. We are looking for intersecting streets.
Student:	Exchange Place and New Street
Eva:	Very good.

The students were able to make subsequent real world application with the three vocabulary words when Eva asked them to look around the classroom and find examples of each word. The students identified examples of intersecting, perpendicular, and parallel lines in the classroom. For example, a student pointed out that the border around the bulletin board is an example of perpendicular lines.

After sitting for a while the students were ready for another game, which they called the "fly-swatter game." Eva projected a picture using the document reader on the screen at the front of the classroom. The picture consisted of nine objects that exemplified the three vocabulary words. For example, one picture showed a train track, another showed a clock face, yet another a stair case. Two students stood in front of the screen holding fly-swatters in their hands. When the teacher called out one of the vocabulary words, the object of the game was to see who could be first in touching the appropriate picture with his or her fly-swatter. For example, if Eva called out "parallel" the first one to touch the appropriate picture won the point for his or her team. They played this game until everyone in the room had had at least one chance to participate.

To end the lesson, Eva had the students work together to complete a activity sheet. She put the activity sheet on the screen in the front of the class using the document reader. One question was: What line is perpendicular to line z? Eva asked the students what they would do first to answer this question. A student responded: "highlight the word perpendicular." Eva: "Definitely look for those key words." Student: "You would rewrite the word perpendicular replacing the lowercase 'l' with capitol 'L.'" Eva encouraged the students to "remember to look for the key words, the vocabulary words, and define them before diving into the answer choices." She continued to work problems on the activity sheet with the students until it was time to end class. The students spontaneously engaged in naming the vocabulary words to each other as they gathered up their belongings to go to another class.

Features of Math Instruction Utilized by Eva

In this section I identify the features and present the themes which characterized Eva's teaching. The following patterns or themes were derived from all observations combined and they present the most frequently occurring features of Eva's math instruction. These features include: reviewing previously learned concepts; making learning relevant; making instruction comprehensible; teaching through music, rhymes, movement, and visuals; using collaborative groups; using motivation and engagement; monitoring progress and checking for understanding; and supports for struggling learners.

Reviewing previously learned concepts. Eva tries to review previously learned concepts whenever possible. She recounted that "I think it's so much information that they are expected to remember and for the amount of concepts we're teaching if we tie it into previously taught concepts, I think it's more memorable that way." For example, on a lesson about prediction, she reviewed what they had learned about probability.

Eva:	Let's talk about probability before we get started with prediction. What can you tell me about probability that we've covered?
Student:	Total
Eva:	How to we write probability? In the form of a…?
Student:	Fraction.
Eva:	What can you tell me about the fraction and total in probability? Where does the total go in the fraction?
Student:	In the denominator.
Eva:	Very good use of vocabulary. If I were to put all these letters (in the word probability) on individual cards and throw them in a bag, and I reach in and I pull one out what is the probability that I would pull out the letter i? What is the first thing I am going to do?
Student:	Put the total.
Eva:	And what is the total going to be?

Student: 11 (there are 11 letters in the word probability).

Eva: Very good, we count all the letters. So the denominator is going to be 11. What is your numerator going to be?

Student: Two.

Eva: Our numerator is going to be two. Explain to us why.

Student: Because there are two i's in the word probability.

Eva: Very good. I wanted to go over this because this is where you start off when you are going into predictions. I can use this information to find out what would be the probability if I were to write the word twice, double the letters, what would be the probability of pulling out the letter i?

Eva then proceeded to a lesson on predictions. In another instance she reviewed place value with whole numbers to the 100 billions place as in introduction to a lesson on place value with decimals. She passed out small paper jerseys that had place values written on them up to the 100 billions place. The students put on their jerseys and arranged themselves in the correct order according to their place value without talking. They did the activity twice to make sure everyone had a chance to participate. She then followed with a lesson on place value with decimals. Yet another time she reviewed *one-digit divisor* with *two-digit dividend* as an introduction to *two- digit divisor* with *three-digit dividend.*

Using Activity sheets. Although Eva used activity sheets for a variety of reasons, including introducing new concepts, she also used them to reinforce vocabulary or to review previously learned concepts. Activity sheets were mostly done together as a class rather than individually although a few times she had students work on them individually. One class period Eva passed out a activity sheet to review previously learned concepts, perimeter, area, and volume. She told the students the first thing they should do is go to their math chart where they could find the formulas and secondly to get a highlighter to mark key words. The first question was: "Haley wanted to put a skirt around her desk to

hide her computer equipment and cords. She measured her desk and found the dimensions and drew a sketch. The sketch showed a rectangle with the dimensions of 48 x 18."

Question: "Which equation will not help Haley find the perimeter of her desk?

A. Perimeter = 2 x (48 + 18)

B. Perimeter = (2 x 48) + (2 x 18)

C. Perimeter = 48 x 18

D. Perimeter = 48 + 18 + 48 + 18."

Eva asked the students to identify some of the important words in the question. Students responded: "skirt around, not help Haley, and find the perimeter." Eva went through each answer choice with the students and together they found that the correct answer was C because it is the formula for area.

Using journals. I noticed through my observations that students wrote in their journals almost every day. When I asked Eva how she used the journals, she explained that they served to record information to which the students could refer to when they are completing their homework. Previously the students tended to lose papers and would not have them available during classwork or when doing their homework. So she began to have them glue or tape most activities into their journals. They also use it for note taking. They have a journal for each subject, math, science, and reading. When they are doing their math homework the journals serve as a central place where all their information is located. Eva indicated that it made a good study guide to review previously learned information.

Making learning relevant. Making learning relevant to students was important to Eva. I observed that she does this in at least two ways. Through using students background knowledge and through use of real world applications.

Using students' background knowledge. I asked Eva about her students' background knowledge. She stated that student's background knowledge might not be the same as hers or the same as the other students in the room, "but it is pretty much…the

way they are being raised." I asked her how she uses student's background knowledge in teaching. She said it mostly had to do with motivation. She related a story about a recent field trip she had taken with her class. They visited the local university. She said they asked the tour guide if they could sit in the seats in an auditorium classroom. The students loved it. But on the way home, a number of the students said that college was not an option for them because they could not afford it. Eva and the other adults on the trip told the students that they were only able to afford college because of financial aid. Eva said the students' eyes just lit up when they heard that with "oh, there's a possibility." Eva added: "So you may think you struggle for different reasons but there is always a way out of whatever it is you are living through right now."

Eva tries to tie students' learning to their background knowledge and their previous school experiences. I asked Eva how she determines what students' background knowledge is. Although I intended the question to refer to students' lives outside school, her response indicated that she was thinking about the students past school experiences. She said that she bases it on their previous math scores and primarily on classroom participation.

> On Mondays I introduce the concept based on what they already know. Because sometimes they don't do well on standardized tests so I don't go completely on that. But just what they bring to the classroom once we start a new lesson. As well as, I do take into account how well they did the previous year.

Using real world application. Eva indicated that she does try to bring in students' home lives into instruction whenever possible. For example the students were given a hypothetical sum of money and a grocery list and they were asked to use the skill of estimation in order to "spend" their money wisely. She also related math to their parents paying their bills. She explained: "Once we can relate to something that they are familiar with then they are like: 'oh, OK.'" Because their math program contains examples with which the students are completely unfamiliar, such as going to the opera, Eva said she tries to find things students can relate to, even in simple word problems. "They have no

idea of what going to the opera means, that's not something they can relate to. We have to find something that they can be familiar with."

Eva reminded her students that math is not just a lesson on which you take a test at the end of the week. She told them that, as adults, they would have to use math every day whether they are a teacher or a housewife. To reinforce this point, she frequently connects math problems to everyday situations, such as, "you're at the store and you do this, how would you go about this problem?" She explained, "We try to relate it back to their families, how would they apply it in the real world?" In a lesson on perimeter, area, and volume, Eva had the students look around the classroom and find examples of each. The students' answers included the door frame or the border around the bulletin board for perimeter, the grass in a yard or the rug on a floor for area, and filling boxes when you are moving, a filing cabinet, or a purse for volume.

In a lesson on division Eva asked her students to think of real world applications. She said, for example: "I have two children, if I have seven cookies could I give all seven to one child? No, I would have to think about breaking them evenly between the two children." In another example she said: "If I wanted to buy lollipops for the classroom and they came in bags of five, how many bags would I need?" Students: "four"

I asked Eva why she used real world examples. She replied that on the state achievement tests, it is not enough to know what perimeter is, students have to be able to recognize a real life problem, and the question might be about perimeter without ever mentioning the word *perimeter*. She said they are giving them real world examples and students need to be able to realize that that's what the question is about without seeing the word itself. So her rationale is partly related to passing the test but also how to apply these concepts in the real world. Eva affirmed:

> A lot of times it's like, "OK, we learned this, is it only for a test?" And I try to tell them, "you're going to use this throughout life. If you want to build a fence around your house you can't just go out and buy materials, you need to know how much" and just so they know how to apply it.

Making instruction comprehensible. Eva utilized three main ways to make instruction comprehensible to her students. They were using the Spanish language, modeling on the board, and vocabulary review.

Using the Spanish language. During one of my observations, I noticed that Eva walked over to a student in her classroom and spoke to him in Spanish. I later asked her how she works with students who are ELL's. She answered that some of their ELL students were repeatedly unsuccessful until they realized that the teachers could speak Spanish. They would ask the teachers a question in Spanish and the teachers would answer in Spanish then translate into English. Eva said: "I guess they know what questions they wanted to ask they just couldn't word it in English. So the fact that we are bi-lingual really helped us out in that sense." I asked Eva if she was providing the vocabulary words in Spanish or if she was explaining the concepts in Spanish to them. She responded that she did not explain the concept in Spanish. In the majority of cases, she translated words from English to Spanish if they did not know the English word.

Modeling on the board. Eva often used the white board or the smart board to model how to work math problems. One lesson I observed involved equivalent fractions. To begin the lesson, she had the students write the words equivalent fractions in their journals. Then they wrote the definition: "fractions that have the same value." She reviewed the meaning of the words numerator and denominator. Then she told the students: "There is a very important rule when you are dealing with equivalent fractions. That is: what you do to the bottom, you do to the top." She used the example of 1/3 and 2/6. She drew a rectangle on the board and divided it into three equal parts. She drew another rectangle on the board and divided it into six equal parts. She shaded in the equivalent parts in both drawings. She then explained: "in order to get the six on the bottom, I multiplied the three by two. What I do to the bottom I do to the top. So now I multiply the one by two to make 2/6." She used 2/4 as her next example. She drew a rectangle on the board with four equal parts and shaded in two of them. She drew a second rectangle on the board and divided it into 12 equal parts. She said: "3 x 4 = 12 and

the 12 goes in the denominator. What you do to the bottom you do to the top so 3 x 2 = 6. If I shade in both parts, it means that 2/4 is equivalent to 6/12." She continued with several more examples of equivalent fractions on the board.

Vocabulary review. On several occasions Eva began the day's lesson with a review of previously learned vocabulary. For example one day she began the class with a review of definitions used in multiplication. She addressed the class:

Eva: Can somebody tell me what factors are?

Student: It involves multiplication and division that uses the same numbers.

Eva: You are correct in that it involves multiplication… a factor is a number that you multiply to get a given product. There is another vocabulary word in there: product, can anybody tell me what a product means?

Student: The answer when you multiply.

Eva: The way we can remember these two words is: factor times factor equals product.

On another day, the lesson was on division and once again she began the lesson with a vocabulary review.

Eva: Someone give me a vocabulary word that we can relate to the concept of division.

Student: Quotient.

Eva: Can you, in your own words, give me the definition of quotient?

Student: The answer when you divide.

Eva: Can someone give me another vocabulary word associated with division?

Student: Divisible.

Eva: What does the word divisible mean?

Student: When you divide and have no remainder.

Eva: In the problem 10 ÷ 2 = 5 what are the numbers called?

Student: Five is the quotient, two is the divisor, and 10 is the dividend.

Eva: In your own words, what is a remainder?

Student: The amount left over after division.

Teaching through music, rhymes, movement, and visuals. Eva tried to use as many different learning pathways (music, rhymes, movement, and visuals) as possible during her lessons. She often used physical movement, manipulatives, rhymes and sayings, and visual aids in her teaching.

Using movement. During a lesson about prediction, Eva had the students generate their own data by playing a basketball game using a portable basketball hoop she had set up in her classroom. After the students had a chance to make a basket, they answered questions about their data. One of the questions was: "The boys made 7 shots out of 14 tries, how many shots will they make out of 28 tries?" I asked Eva what the purpose was for having the students generate their own data. She replied:

> It is just to get them out of the routine of paper and pencil first of all. Secondly, just to let them know that you don't need someone to give you numbers to be able to perform these concepts. Also, it gives them the physical activity; it gets them out of their desks. The students are more likely to be excited about an activity and to participate more when they can get out of their desks for a little while.

There were other instances where Eva used movement as part of her lesson. As with the lesson noted previously where students used their arms to depict parallel, intersecting, and perpendicular lines Eva noted:

> I think the motions give them the visual, they are actually able to visualize it so when they're attempting a question on their own, and it's a little bit more memorable rather than just the note taking as well as the physical activity during class. Because sometimes an hour of sitting in your desk motionless or simply writing, you'll lose their attention, and so just to keep them active but at the same time doing the review. So mainly it's for the actions and to keep them physical and to give them the visuals.

Using manipulatives. One of the things Eva does to engage her students is to utilize hands on activities in the classroom. For example, she said she loves to bring in candy and food as manipulatives. She likes to use anything besides the regular

manipulatives (such as number rods) that you would normally use in a math classroom; "something that is really going to stick in their heads." She adds that they really enjoy that. She conveyed:

> The candy is more to entice them more than anything else because like I said, I tell my team sometimes, I feel like we are performers; we have to get their attention because as it is they are very intimidated by the math. By any subject. If they're coming in scared giving them pencil and paper, the fear is there already and then the boredom on top of it, they're not going to do very well. So I think all of that is "OK, look candy, let's get to work with the math now." It's more I have your attention, now let's apply the math concepts.

Eva used candy in a lesson on perimeter, area, and volume. To each student she handed out a book cover folded into three equal parts. They used the blank side of the book cover. She handed them candy shaped paper cutouts that they glued to the top of each section of the book cover. Students wrote *perimeter, area,* and *volume* in each candy cut out. She then passed out math charts with the formula for perimeter, area, and volume on them. She had them draw, using the inches on their math chart, a rectangle in the first section that measured three inches in length and two inches in width. Eva then passed out bags of candy to each student containing twizzlers, skittles, and miniature marshmallows. She instructed the students to take out the twizzlers and then seal the bag so they wouldn't be tempted to eat it. She then told the students to peel off two strips off the twizzlers. She asked: "If the first candy is twizzlers, where do you think we are going to put the twizzlers? The students answered: "around the rectangle." Eva then told the students to put glue on the perimeter of the rectangle and glue on the twizzler strips. She asked the students if they needed to cover the inside of the rectangle. The students responded: "No, that's for area." She next led the students in an exercise to learn that the perimeter of the rectangle they created was 10 inches.

Eva told her students the next section was for area. She instructed them to take 12 skittles out of their bags. They then glued the skittles onto their paper in a 3 x 4 array. Eva encouraged her students to make sure the skittles were all touching each other in order to cover the entire area of the rectangle.

The last section was for volume. Eva asked her students: "When we are talking about volume are we talking about two dimensional figures or three dimensional?" Students: "three dimensional." Eva asked her students which dimensions had they been working with. The students responded "length and width." Eva: "With volume, which dimension are we adding?" Students: "Height." Eva said: "We are going to use miniature marshmallows to create a three dimensional figure." Eva instructed her students to take eight marshmallows out of their bags and glue four marshmallows right next to each other just like they did with the skittles. The width was two marshmallows and the length was four marshmallows and the height was two marshmallows. She told her students to "Go ahead and stack another marshmallow on top of the ones already there." She asked her students what shape they created. They responded: "a rectangular prism." She then took the students through an exercise to discover that they had created a rectangular prism of 4 x 2 x 2 or 16 cubic marshmallows. I observed that the students were well engaged throughout this exercise.

The use of manipulatives is one of Eva's primary methods of modifying instruction for students who have LD. I asked Eva how her instruction was different for students with LD. She responded that she uses more manipulatives and visuals with students with LD. She also reported that she was glad that they had inclusion support. She said she has two students with LD in her classroom (her homeroom). A third student has Tourette's syndrome and Eva tries to keep her calm and keep things flowing in the classroom. One of the two students with LD in her home room has difficulty writing. He was not able to keep up with the writing that they have in fifth grade. She indicated that she would give him printouts where he would just have to fill in the blank. She modified his work so he is able to follow along and not do as much writing. Besides that, she uses many more of the manipulatives with him.

Before the first administration of the state achievement test, Eva was able to work more with the students with LD during school hours due to the fact that they made an intervention plan. She was able to work in small groups with those students. During the

regular school year, it has to be after school. Eva said the students in her class were at all different levels although they are all very low and the students with learning disabilities need a lot more hands manipulatives and visuals as opposed to the general population.

Using memory aids. Eva used memory aids to assist her students in remembering information. The two types of memory aids she used most often were rhymes and sayings and visual aids.

Using rhymes and sayings. Eva uses rhymes and sayings to help her students remember math rules. For example, the rhyme for rounding numbers was, "five and up bump it up, four or less, let it rest." The rule for making equivalent fractions was, "what you do to the bottom you do to the top." Another rule for division was "divisible is when you divide and the remainder is invisible." Eva explained that many of the rhymes or sayings made it easier to remember math rules. "Because a lot of times, that's what they need." The rhymes and sayings they learn are put in their math journals. They write them down and practice them then Eva will give them a quiz. If the students remember them, they receive a reward. She said "things like that help trigger their memory."

Using visual aids. Eva said she uses visuals to help students make sense of new information. During a lesson on place value with whole numbers and decimals, Eva had thm cut out a drawing of a person's head and shoulders. They glued on strips of paper for the arms and cut out drawings of hands and glued them to the arms. The arms were held out straight from the shoulder. Eva called the cut-outs either Peter or Patty Vela or P.V. for place value. Students drew in a heart on their figure to represent the decimal. They drew a decimal inside Peter or Patty's heart. The students wrote *whole numbers* on the left arm of their figure. They wrote the number one inside their figure to the left of the decimal. On the left arm of the figure, they wrote the numbers *10* on the shoulder, *100* on the elbow, and *1,000* on the wrist. The students then wrote the words *decimal numbers* on the right arm of their figure. Eva pointed out to the students that decimals have the same value on the right side as they did on the left. But instead of saying 10's we say 10ths. The shoulder on the right has the place value of 10ths, the elbow has the place value of

100ths, and the wrist has the place value of 1,000ths. Eva says: "I could have just said 10's, 100's, 1,000's, but it would have just confused them so I needed to give them some sort of visual…and things like that I think help them remember the strategies a little bit better."

A second example of using visual aids in the math classroom was a lesson on creating a factor wheel. Eva told her students that one of the skills they were going to master that year was learning to find all the factors of a given number or all the numbers that one can multiply to get a given number. She told them they were going to create a "factor wheel. A factor wheel is a tool that gives you the rules for each number. The factor wheel forces you to look at one number at a time and not skip any." Eva took her students through the steps of creating the factor wheel which consisted of two paper plates. One had a circle divided into 10 slices glued on it. The other paper plate had one slice cut out of it and served to spin around on the paper plate that had the slices. Each slice of the factor wheel held a number and the rule for that number. For example, the rule for number *1* was it is a factor for all numbers. Number 2 had the rule it is a factor of all even numbers. For the number 3, "find the sum of all the digits in the number. If the sum is divisible by 3 than the number is also divisible by 3." The factor wheel continued in like manner for all numbers up to 10. For the remainder of the period, Eva led the class in factoring different numbers using the factor wheel.

Motivation and engagement. Eva indicated that one of the reasons she is successful at teaching math is the degree to which she is able to engage students in their learning. In this section I review some of the means by which Eva motivates and engages her students. They include recognizing student performance and playing games.

Recognizing student performance. Eva recognizes student performance in two main ways, through an All-Stars bulletin board and by giving out tangible rewards. Eva has two bulletin boards in her classroom. One she uses for the calendar and for weekly vocabulary words and the other is reserved for math All-Stars. During the first six weeks of school, the names of all students who scored one 100% on the weekly tests were put

up on a star on the All-Star bulletin board. In subsequent six weeks, students had to score 100%'s on two weekly tests in order get their name on the bulletin board. Eva also has a reward for the math All-Stars every six weeks. Eva reported that the students really try to score 100% so their names can go up there. She said: "so, it's just a motivator."

When Eva's class plays games, she usually has a small reward for the winners. Also, I observed one instance when students gave correct answers to problems, Eva gave them raffle tickets. She says "little rewards, little prizes like a pencil to them is such a big deal." She can really motivate the students with "OK, you'll get to pick out a pencil out of the pencil box." They are very appreciative of small rewards. It makes it really easy to motivate them and encourage them with the smallest rewards like a smelly sticker. Eva says: "So I really appreciate how they appreciate everything I do for them. It keeps me motivated."

***Playing games*.** Eva frequently used games to keep students engaged during a lesson. She also used the games for further practice with concepts and to reinforce vocabulary. When I asked her why she used the games, she explained:

> The games again are more for their attention…so that it can be an enjoyable lesson. I know we could just use paper and pencil but that's not going to stick with them very well and not only that but once you turn it into a competition they want to learn it…I usually have some kind of prize for the winning team because if it's just a matter of learn it because I said so it's not going to work as well as with a game. You win you get rewarded or just the pure joy of "I won, I knew it," so I think it puts a little more pressure on them to learn it because they want to be able to compete in the games.

During a lesson on place value with decimals, Eva divided the classroom into two teams. She then passed out some large foam dice to a student sitting in the front of the room. Students rolled the dice to generate numbers that another student wrote on the board that included a decimal point. A student on the opposite team had to read the number correctly in order to get a point for his or her team. The first number was 6,666.062. A student from the opposite team read the number correctly as 6 thousand, 6

hundred 66 and 62 thousandths. Each team continued in like manner to the end of the period.

During a lesson on predictions, Eva asked the class to generate their own data by playing a game of basketball. She had a portable basketball net in her classroom. The class divided into two teams; boys vs. girls. The boys went first. A tally mark was recorded on the board for each shot the boys made. They made 7 and missed 7 for a total of 14 shots. The girls made 6 and missed 12 for a total of 18 shots. After the game, the first question Eva asked the class was, how many baskets would the boys make out of 28 shots? The students responded with the prediction that they would make 14 baskets.

To end a lesson on polygons, the students played the fly swatter game. Eva put up a picture of several polygons on the screen in the front of the classroom with the document reader. The room was divided into two teams, boys and girls. Eva called out the name of a polygon and whoever was the first to touch that picture with their fly swatter won a point for his or her team.

Planning, monitoring progress and checking for understanding. Eva uses lesson plans and informal and formal assessments to plan for instruction and to assess learning.

***Using lesson plans and assessments*.** Lesson plans are used by Eva mainly as a guide. She said if she sees students struggling with something she does not adhere to her plan. It serves more as a framework or a guide that she modifies as needed. To her, lesson plans are more for documentation purposes rather than something to which she adheres strictly in the classroom. She said: "There is always something that is needed that is not in the plan, and things in there that are not needed. So, it's just a guide, pretty much."

Eva assesses students both formally and informally. She assesses students informally through oral activities and through team work and games. She shared that most of the time students do group activities that provide opportunities for them to help each other out. But once they get to more independent activities she can tell who is grasping the concept and who is not. She does not use homework for assessment

purposes because they may have received help or they could have used other resources. But by giving them independent work in the classroom, she is able to see who understands the material. More formal assessments are conducted through their math curriculum *Sharon Wells Math*. She assesses students weekly based on the skill that was taught that week. The curriculum assessment questions tap different concepts. That is, they integrate previously covered concepts in questions that evaluate the target concept. The majority of questions focus on the concept that they have studied in a given week, although the authors of the curriculum will include a few questions from previous weeks. Eva noted that the six week exam is a cumulative exam so that she can see if the students can "put it all together."

Supports for struggling learners. Eva offers several types of supports for struggling learners in her classroom. Besides using manipulatives for students with LD, she also uses: peer and individual tutoring, helping students break it down, determining individual needs, and managing challenging behavior.

***Peer and individual tutoring*.** Eva provides peer tutoring during class and individual tutoring during the afternoons and after school for students who are struggling. She explained that peer tutoring is necessary because the class moves at a fast pace and it is difficult for the ones who are struggling to keep up. Eva indicated that sometimes students will tend to "just sit there" if they feel lost, so she pairs them up with a higher functioning peer to give them the attention she is unable to provide during class just to make sure they are keeping up.

Eva provides individual or small group tutorials after school and after lunch to students who are significantly below grade level. She explained students have their computer lab, PE, and their composition time after lunch, so rather than having them work on the computer she will take some of the students aside for a tutoring session.

I asked Eva to describe what she does when tutoring. She replied that frequently reviews the basics with them. Much of the time they do not understand the fifth grade concepts because they have not understood prerequisite concepts so she tries to re-teach.

She keeps going back until she has identified the concept or skill that they have not mastered. For example, she shared that they might not know multiplication skills that they should have learned in third grade. Or they might not know how to divide a two digit dividend with a one digit divisor, a necessary skill for learning to compute with a two digit divisor. "So a lot of times it is just going back to the basics and pulling out the basic manipulatives that were used previously, so a lot of going back to the basics with them."

Helping students break it down. Eva uses a division monster to help students break down the steps in division problems. On the board, she has a picture of a monster in the place of the divisor and three squares covered with doors in the pace of the dividend. She told the students to think of the division problem as a monster trying to fit through these doors. She said: "If there was a one-foot door, and I am the monster at 5' 3'', would I be able to fit through a one-foot door?" "No," said the students. Eva then asked the students if she could fit through the door to the classroom. The students said "Yes." Eva said "Yes because, I the divisor am smaller than the door. The door represents the dividend. Eva said, "the divisor in our problem is going to be 15." She wrote *15* on the face of the monster on the board and instructed the students to do the same on their piece of paper which had a picture of a monster beside three squares. The dividend was *273*. They covered the dividend with their doors. Eva:

> So this monster can't just say, OK, I'm going to walk through the door. We need to do one digit at a time. We need to break it up because we are working with much bigger numbers and we're trying to break it down to make it easier for you. Eva instructed the students to open the first door which was a 2.
>
> Eva: How tall is the first door?
>
> Students: Two.
>
> Eva: How tall is the monster?
>
> Students: Fifteen.
>
> Eva: Is the monster going to fit through the first door?
>
> Students: No.

Eva: So since he doesn't fit through the first door, we can open a second door.

Eva took the students through the steps to solve the problem using the monster and the doors.

Determining individual needs. Eva noted that it is difficult to meet the needs of individual students because she is working with 80 students. However, she does assessments every week so she can identify a student who normally does well whose performance may drop one week so she will know what he or she needs to work on. In the afternoons, she takes those students aside and works with them individually and re-evaluates. She said: "But testing every week, I'll add on a few questions from previous concepts, but that's where I am able to see, OK, this is what they are specifically having trouble with. If we address it right away, usually we're able to correct it."

Managing challenging behavior. Eva disclosed that they had a student the previous year who was labeled *oppositional defiant*. She said very few people could work with this child. Very few people had the patience to work with him. They didn't know if he would react by having a temper tantrum and throwing a desk at them or what he would do. They were afraid of correcting his behavior for fear of what he may do but sometimes it was necessary if the safety of another child was at stake. Eva reported that by the end of the year he had learned to trust them. She said that he wouldn't work with anyone but the three fifth grade teachers. But she said "it was like walking on eggshells." They tried to discipline him but were careful not to upset him. But by the end of the year they had figured out how to work with him.

AMY

Amy is a Mexican-American woman who has taught third grade at González Elementary School (pseudonym) for the last 10 years. She taught second grade for the first four years and has been teaching third grade for the last six. Amy was born and raised in the same city in the Rio Grande Valley of south Texas where she resides today. She has lived there for 34 years. Amy described her family growing up as "low-income,

below poverty level." She shared that her family was migrant as she was growing up and they spent their summers in Minnesota and Michigan. Amy is bi-lingual and speaks, reads, and writes in Spanish and English. She also jokingly says she speaks "Spanglish or Tex-Mex" which is a combination of the two languages that many Latino/a's speak in south Texas. However she identifies herself as an American, saying, "I am very proud to be an American and so that's how I identify myself."

Amy graduated from the local university where she majored in elementary education. I asked Amy when she knew that she wanted to become a teacher. She replied: "In fifth grade. I wanted to be like Mrs. Hernández. She still tutors at the public library on Saturdays. Since fifth grade I wanted to be like her." Mrs. Hernández, her fifth grade teacher, influenced her because she took a special interest in her. Amy described herself as that student who "needed that extra push." She said:

> My whole academic career changed in fifth grade. She [her teacher] made me strive to want to be a better student. She gave me the tools. There are teachers who want to make you strive but they don't know how to make you strive. She just did. If I didn't understand something she made sure that I understood it. I understood my material and I excelled in it. Back then I think it was the Texas Assessment of Academic Skills (TAAS). And I got a perfect score in TAAS. At the fifth grade banquet I got a plaque. That definitely changed my whole outlook. So she impacted my life.

She described herself as a very loyal person and one who prefers familiarity. She remarked that she prefers second grade but is grateful that she experienced teaching a different grade level because it has given her a different perspective, especially the difference between a grade in which the students take the state assessments and a non-testing grade. Because second graders do not participate in the state standardized the teaching experience is very different. She also disclosed that she has become interested in teaching special education in the life skills unit as a result of interacting with students in the life skills program for the first time this year.

Perceived effectiveness of pre-service and in-service training. The pre-service training that Amy received at her university has not been very helpful in teaching

different groups of students such as those with gifts and talents (GT), those with learning disabilities (LD), and those from lower socioeconomic status (SES) backgrounds. Amy reported that in-service trainings have not been very helpful either. She conveyed that her co-workers have been more helpful than workshops. She related that sometimes workshops are helpful but she believes that "sometimes a person needs that correlation with someone else to be able to see the different perspectives and that helps you get more out of the workshop." She recalled more training with students with LD because some of her university classes were specifically geared toward students with disabilities. As a result, she feels better equipped to deal with students with disabilities as opposed to GT students because her course work did not address teaching GT students. Amy believes that this could be so because there are more students identified with LD than there are GT. I asked Amy if she had received any preparation to teach students from low-income families. She replied: "No and I don't think that you need training if that's the kind of background that you have yourself." I also asked her about ELL students. Her response was that she was an ELL student and that a person can better identify with students if they have been in a similar situation themselves. Her first language was Spanish, so she can relate to the struggles that her ELL students experience. She asserted that being a non-native speaker of English makes her better prepared to deal with her ELL students. Amy reported that she has four students in her classroom who are identified as ELLs but there are others whose first language is Spanish but they are not identified as ELLs.

At the present time, Amy does not have any students with LD in her classroom. However, she has two students with more severe disabilities attend her classroom for 45 minutes a day during reading for inclusion. She shared that it has been a challenge because she has no prior experience working with students with more severe disabilities. She feels she definitely has to lower expectations or "tone down" because she had expected certain things "but it was a real eye opener." She has also had to learn to work with their paraeducator. She said: "I didn't know what to expect so…that's just been an eye opener."

I asked Amy if she had had any training on working with students from various ethnicities or cultures. She said: "No, because almost all our students are from the same culture. We don't have a lot of variety; it's all from the same culture…maybe different religions, but not necessarily from a different culture."

VIEWS ON TEACHING

Amy's philosophy of teaching is that the teacher has to be a role model for the kind of behavior that she expects. "So if I expect students to do their work, then I have to model that." Amy emphasizes that everything has to be modeled for them. She reiterates "everything that I expect needs to be modeled for them. So they can in turn model that same expectation back to me."

For Amy, the interactions that she has with her students comprise the most enjoyable aspects of teaching, especially when she teaches them something new and she can see that they actually learned it. "And you feel like, wow! I'm the one who taught them that. That's a good feeling." Amy states that she likes the fact that she can get students excited about a concept, when she gets to see them excited about learning something new she feels that she is empowering them to learn more. What she likes least about teaching is the grading. She does not mind assigning them grades as much as taking the time to complete the paperwork. However, she realizes the necessity as grades allow her to see whether or not students are learning.

Positive and negative interactions. Amy reported that she had a positive interaction with a student just recently. One of her students scored at the *limited* level at the beginning of the year when she tested him on the Texas Primary Reading Inventory (TPRI), i.e. the story had to be read to him. Then in the middle of the year one story had to be read to him but he read the second one himself. When she tested him recently he read both stories at 70 words per minute. She said she just "wanted to do a back flip. I was so excited. He was excited too."

A negative interaction with a student that Amy recounted involved a student who had an academic problem mixed with a behavior problem. She reported that this student

had a very negative attitude. When she saw that he was not getting something and she tried to redirect him it led to a problem behavior. He rolled his eyes at her when she tried to redirect him. The behavior often escalated to the student slapping a chair and accusing Amy of being mean. Even when Amy was very careful to moderate her tone of voice, the student complained that she was being mean. When Amy tried to bring the parent in to the conversation, the parent sided with the student and accused Amy of being mean also. Amy said: "How am I being mean? Just because I have to redirect him. I don't see that as being mean." Amy remarked that this was a pattern for this student and that she is not the only teacher to experience difficulties with him. She conveyed that she has another student with problem behaviors also. This student is extremely smart but "it's not being used because he gets into these behavior issues. He can't be academically successful because of his behavior issues." She says that he could easily be a "straight A" student. But right now he's failing half of the classwork. Recently he was behaving inappropriately in the classroom setting and Amy reported that it took 30 to 35 minutes away from class time to "get it fixed. That was a real negative experience because like they say: 'such a gifted mind to be wasted.'" Amy indicated that she did not feel she could do much. She attributed his problems to his home environment and observed that he had great potential but instead "I see him in jail or something."

Amy identified three challenges she faces in teaching: time, the wide range of academic abilities in her classroom, and students' challenging behavior. She said it's time because there are a lot of things that she would like to do for students but there is not enough time. She would like to make more time to teach students individually but she cannot because she has 23 other students. But she can see the difference in their performance when she is able to work with them individually rather than in the larger group. Another thing she finds challenging is the large variety of academic ability "So," she says, "you want him to have higher order thinking and go in and solve these long word problems in math and he's already saying: 'no' or 'I can't.' So besides the variety in academic ability it's the behavior."

Successful and unsuccessful students. Amy described her view of a successful student as one who applies the strategies that they are taught, is open minded to help, and stays on task. She described a female student in her class as an example. She shared that this student is gifted and talented. She absorbs any strategy that Amy teaches her, and applies anything that she is told. Amy indicated that some students don't try to implement even one strategy that they have been taught. But this student will apply anything she is taught. She is strong in all academic subjects and stays on task. Along the same vein, Amy shared that a good student is one who is willing to work. She averred that some are smart but do not become actively involved in the lesson. A good student is willing to try and is open minded and open to help even though they may be struggling.

In contrast, Amy described an unsuccessful student as one who will not apply the strategies they are taught, is unwilling to work, and lacks perseverance. As an example, she shared that she has a student who is not doing well across all subjects. When he gets into trouble he has a tendency to cry. He was at another school last year and his mother reported that he did not learn much in second grade last year because he was being bullied. This year his performance is significantly below grade level, his grades have not improved in third grade. Amy noted that she would sit with him individually and teach him different strategies to solve a problem but he does not apply them. She feels he will not apply himself and is easily discouraged. Amy reported that any work that she sends home with him his mother comments: "that's too hard for him; I learned that in high school, not third grade." Consequently she feels she does not have parental support.

What students need most to be successful. Amy charged that there are three main things that students need most to be successful in life: work diligently, be persistent, and learn that they are not alone in their quest in life. Part of working diligently is remaining focused, to work diligently means to remain on task without getting side-tracked with other things. Students also need to be persistent. Amy tells her students: "you always have to be persistent about what you want in life. Because you're going to

run into obstacles that are going to exist financially and personally." Amy remarked that many of the students come from divorced families.

> That's an obstacle that some of them have to overcome. They have to be persistent in overcoming that. They are going to have to be persistent in overcoming their financial circumstances. Right now they have to be persistent in school, but eventually they will have to persistent in the job that they have.

Amy states that if students want their own home someday, they will have to be persistent in getting the kind of job that will allow them to own a home. Finally, students need to learn that they are not alone. This is something the students learn with cooperative grouping. There are always going to be people who will help them achieve. "When they work in cooperative groups, that's teaching them, 'hey, you have a partner. Not to give it to you, but to help you.'"

Working with parents. For the most part, Amy's expectations for parent involvement include making sure that a student's homework is done and communicating with her. She shared that parents do not hesitate to call or text her if they have concerns. One parent in particular calls Amy if there are any problems, but does not offer to be part of the solution. In this case, the parent does not make sure homework is done. Work sent home comes back incomplete. Amy said this parent makes her aware that her son needs help, but she doesn't see the parent doing her part. Amy communicates with parents through s system she calls "ring five." This is a plan to call five parents in a given time frame (usually one hour) and ask them what their children shared with them about school that day. The students are expected to share with their parents something new they learned in reading or math. It is designed to help students communicate more with their parents and to help Amy communicate more with parents. Amy reported that she has learned a great deal since initiating the program. When she first began, not one of the first five parents that she called between 8:00 and 8:30pm had talked to their children yet. Most often, parents were not home yet or they had just returned home. It made her realize how busy parents were, and made her reflect on the type of homework she had been assigning her students. She concluded that parents were too busy to be of much support

at home. Every one of them had an excuse. The parents either said "I've just gotten home," or "I haven't gotten home," or "I talked to her but we haven't talked about school." Amy said that parents often do not have time to call, but a line of communication opens up if she calls them and they begin to talk to her more.

Amy has had both positive and negative interactions with her students' parents. She said that the interaction is positive when she and the parents feel mutually supported. When parents see what she is doing for their child, and that she is giving them the help and attention the students need, they are supportive of her. A negative interaction concerned a parent whose child had previously received all "As" but whose grades had fallen to the "Bs" in Amy's classroom. The mother was very upset because the child's grade had gone down. During this time, Amy's father passed away and she was absent from school for a few days. Amy said the parent couldn't understand why Amy needed to be away from school and was unavailable to meet with the parent. Amy invited the parent to come and spend some time with her child in the classroom so she might understand the basis for his lower grade but the parent refused. Amy said "it's just been a hard experience over all." Amy said that she now invites a third party to witness any interaction with this parent. If it is a phone call, she puts the call on the speaker phone. She feels that it is unfortunate, but she feels she needs to take these steps to protect herself.

When I asked Amy to identify factors she thinks influence how well students do at school, she replied "their home life definitely. I think more than the teacher." She identified three factors that she believes are problematic: (a) home life interferes with attention and impacts attitude; (b) lack of consequences at home; and (c) the impact of divorce. Amy stated that students bring their worries about home to school with them. "It's hard to leave their environment at home and that definitely affects them here at school." She gave an example of one student who is experiencing difficulties at home and whose attitude in school seems to reflect it. "And so that ruins everything, it ruins his whole day." Amy asserted that the students struggle with consequences for poor

behavior at school because there are no consequences at home. For example, they do not complete their homework for which there are no consequences at home. Ultimately the student "loses out" because the homework relates directly to a concept with which they may have struggled in class. Amy sees divorce as an obstacle for students to overcome. She says: "A lot of our kids come from divorced families. That's an obstacle that some of them have to overcome."

I asked Amy how she works with students who she believes do not have a lot of parental support. She said she tries to give them time at school to complete their homework. She takes the time to meet with them in a mini-conference and tell them what they need to do. She also offers to provide the materials they will need for their project. She offers them her help during her conference period if they want to stay. She does not make an issue over something that can be done at school while the other students are eating their breakfast. She makes extra time for them but she does not publicize that she is doing that because some of the other students might decrease their effort. She will also allow some students to use regular note book paper for a project rather than a big poster board that other students might use. She says that unfortunately there are students who can't do that because their parents are not as involved with them.

A Typical Mathematics Lesson in Amy's Classroom

In the following section I put forth the features of math instruction Amy utilized in her classroom. I begin with the classroom context of an average day in Amy's math classroom. I then go on to advance the aspects of her math instruction that she used on a regular basis. Amy used a wide variety of strategies to teach math to her students.

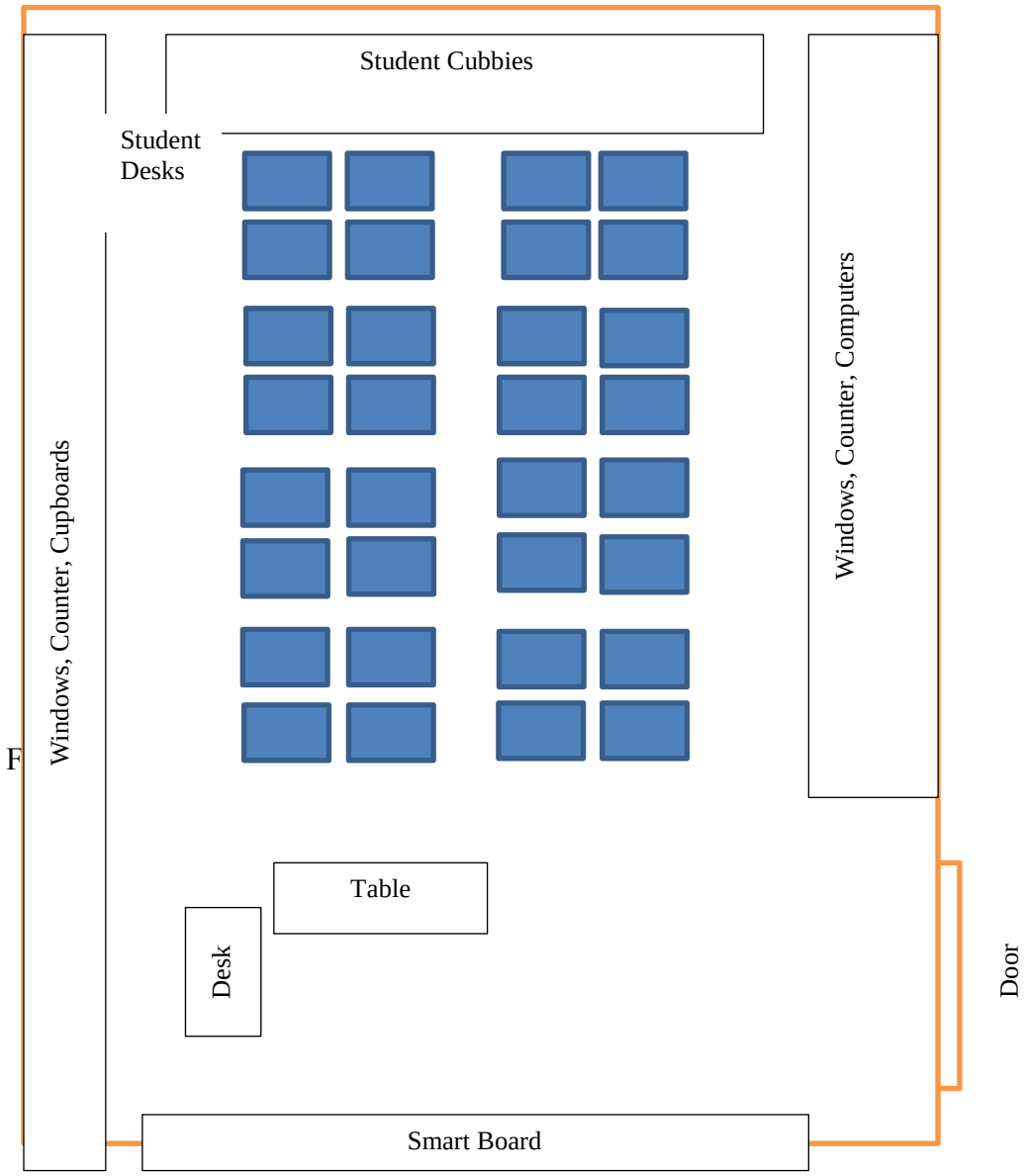


Figure 2: Amy's Classroom

Amy's classroom. As I entered Amy's room the students were transitioning from reading to math (see Figure 2 for a diagram of Amy's classroom). They were putting away their reading books and getting out their math spiral notebooks and getting their pencils and markers ready. Standing in the doorway, to my right is a counter top with four computers

on it. Above the counter are three wide windows that look out into the hallway. Along the back wall are students' cubbies that hold their books, backpacks and coats. Directly across from me is a wall with large windows looking outside. Below these windows is a counter top and under the counter top is a bank of cupboards. To my right a small bookshelf that holds trade books to be used for reading. Further along the wall to my left is a table with the document reader and students' papers to be graded on it. A smartboard screen hangs on the wall behind the table. Amy's desk sits in the corner with her computer and papers on it. The students' desks are grouped in fours and take up the middle of the classroom.

As we waited for everyone to get ready, some students spontaneously engaged in drilling each other on multiplication by sixes. When everyone was ready, Amy opened the class with a game of "around the world" with multiplying by sixes. The game was played by having one student stand behind the student next to him or her. The teacher called out a multiplication problem, (e.g. 6 x 4). The first of the two students to respond correctly moved on to the next student. The student who passed the most students was the winner of the game. They played this game for about five minutes. The students look forward to this game and they played it every time I observed.

The students were already seated in groups of four. Amy passed out one sheet of chart paper per group. The students were to do an activity called "graffiti." The chart paper was going to be their "graffiti board." Amy said: "Today you are going to be learning about telling time. I'm going to give you five minutes and you are either going to write words or sketch a picture about anything you know about telling time." She explained that this activity was meant to help activate their prior knowledge. To begin recalling what they had learned in second grade, in first grade, or wherever they had experience with telling time. Amy reminded the class that some of them were in "Success Maker" (a computer math program they work on during computer lab time) and had worked with time there. She indicated that this activity would allow her to see how much they knew about time. Amy gave the students five minutes to write, after which she said:

> Now another strategy we are going to do is "classroom talk." You're going to talk in your cooperative groups about what you sketched or about what you wrote. You are going to take turns talking about what you wrote to your group. You are all going to have a turn to talk about and discuss what you wrote.

She set the timer for four minutes. When the timer went off she gave the students more time to finish what they were saying. Amy walked around the classroom and listened in on some of the conversations. She asked if there was anyone who wanted to share what they wrote or sketched; several students responded:

> There are 60 minutes in an hour,
>
> The clock is a number line except that it is in a circle,
>
> The clock in the classroom is an analog clock,
>
> There are 60 seconds in one minute,
>
> My grandmother has a cuckoo clock,
>
> It has to do with minutes, hours, and numbers,
>
> ¼ is a fraction of a clock.

Everyone applauded the last statement, and Amy said "I'm very happy that you remembered that from fractions. Does anyone remember what that ¼ is called when we are telling time?" A student answered, ("a quarter"). To which Amy responded: "Very good, yes, a quarter. So how many quarters are there in an hour?" When the students called out the correct answer, Amy noted: "I see that we have a lot of background knowledge on telling time."

Next, Amy showed a video on telling time. She told the students that after the video they could add anything new to their graffiti board. She said she was going to start with the parts of a clock because she noticed that some of them were still having trouble differentiating the hour hand from the minute hand. "And that's ok, that's why we are refreshing our memory. We are seeing what we know and what we don't know." After the video, Amy told the students to write down anything new that they learned from the video. She asked for volunteers to share anything new they had learned from the video. One student offered: "The little hand is the hour hand."

Amy: Is that an important thing to know?

Student: Yes.

Student: A clock never goes counterclockwise.

Amy: Did you know that before this?

Student: No."

Student: Time is important.

Amy: Give me one reason why time is important.

Student: If there were no clocks, you would never know what time to be at school.

Amy had the students put their names on their graffiti boards and said she would collect them after lunch.

Next Amy told the students to open their journals to pages 50 and 51 and open it flat. She said "Shoulder partners please check each other to make sure the pages are the way that I am asking you." She told the students they were going to make a sample of an analog clock and label it because this was going to be their study guide. It was where they were going to refer back to when they wanted a reminder about telling time.

Amy: What do you think we should start off with if I am building a clock?

Student: A circle.

Amy: A circle. The face of a clock is represented as a circle. What should we add to the circle that's on your math journals?

Student: Numbers.

Amy: What should go at the top?

Student: A 12.

Amy: What number is very easy for us to remember that goes at the bottom of the clock?

Student: A 6.

Students and teacher filled in their clocks accordingly. Amy: After working with the class to write in the numbers 3 and 9, Amy instructed them to fill in the rest of the numbers on their clock. Amy said: "I just wanted to thank Kimberley's team. They have been practicing rule number four which is raising your hand. Thank you very much Kimberley's team." While the students were filling out their clocks a student passed out lunch tickets. When they completed the activity, Amy had them line up for lunch.

Features of Math Instruction Utilized by Amy

In this section I identify the features and present the themes of Amy's teaching. The following patterns or themes were derived from all observations combined and they present the most frequently occurring features of Amy's math instruction. The features are: Reviewing previously learned concepts, using activity sheets, using journals, using students' background knowledge, using music, rhymes, movement, and visuals, using rhymes and sayings, using visual aids, and using collaborative groups, motivation and engagement, and supports for struggling learners.

Reviewing previously learned concepts. At the end of a week on learning about fractions, Amy asked her students what they remembered about fractions that they had covered that week. One student offered: "The bigger number goes on the bottom." Another volunteered: "The number on the bottom is called the denominator." Another student offered: "The number on to is called the numerator." One student suggested: "The denominator is the total number." Another put forward that "the numerator is the parts." One student brought up that three out of four students at his table were girls. Amy asked how the boy at that table would be described. Students affirmed: "One out of four students at that table is a boy." Amy responded: "very good. I see a big difference from last Friday to this Friday as to what you have learned about fractions."

Prior to doing a activity sheet problem about telling time, Amy reviewed concepts about telling time with her students. Amy asked her students to tell her about the parts of a clock.

Student: The hour hand and the minute hand.

Amy: Which one is the hour hand and which one is the minute hand?

Student: The hour hand is the short one and the minute hand is the long one.

Amy: Very good. What else can you tell me about the parts of a clock?

One student commented that the numbers tell the minutes and the hours and that every tick represents one minute. Another student declared that the clock could be divided into quarters on the 12, 6, 3, and 9. Amy asked if anyone knew how many minutes were in each quarter. One student gave the correct answer to which Amy replied: "Very good."

On one occasion that I observed, Amy used the information the students had recorded in their geometric booklets to review previously learned concepts. The concept was geometric shapes. She said she wanted the students to take the two minutes before they went to lunch to review the drawings and sketching that they had done in their geometric booklets. She encouraged the students to look at the notes they had talked the previous day. She said it would give them a refresher so that they could continue with that presently. After a few minutes Amy invited students to share what had been covered the previous day about *symmetry* and *congruency.* A student suggested that a horizontal line goes from left to right or from side to side and that a diagonal line goes from one corner to the opposite corner. Another student offered that symmetry is when you fold a paper in half and you have the exact same shape on both sides and that congruent is when two figures are the same size and same shape. Another affirmed that with two dimensional figures you can measure the length and width and a final student offered that a vertical line is from top to bottom. Amy said: "Very good."

Using activity sheets. Amy used activity sheets mostly to review previously learned information. At times she used them to practice recently learned concepts. In one instance Amy put a activity sheet under the document reader for students to solve collaboratively. She reviewed the problem with the class before having the students solve it to build their understanding of the problem. The directions referred to the use of counters or base-10 blocks Amy said they were going to use sketching instead. The first question was:

> For Carters birthday, his mom bought party teats for Carter and eight friends. She bought three packages of party games with six games in each package; two packages of whistles with nine whistles in each package; and 27 candy bars. If his mom wants the party bags to have the same number of games, whistles, and candy bars, how many of each party treat will she put in each party bag?

Amy read a section of the problem and the students repeated together chorally. Amy commented on the difficulty of the sentence.

Amy:	There were packages and packages and packages. What would you advise me to do?
Students:	Go step by step and break it up.
Amy:	What could I sketch to show three packages?
Students:	Draw three boxes. (Amy drew three boxes in her journal under the document reader.)
Amy:	The problem says she bought three packages of party games with six games in each package. How could I do that?
Student:	Draw six circles inside the boxes. (Amy drew six circles inside each of the three boxes.)
Amy:	Mr. Alvarez (pseudonym), could you explain this part back to me?"
Mr. Alvarez:	Three packages with six games in each.
Amy:	Right. The next step says two packages of whistles. How could I show that?
Student:	You could draw two circles." (Amy drew two circles in her journal under the document reader.)
Amy:	There were nine whistles in each package. How could I draw that?
Student:	You could draw nine rectangles in each circle. (Amy drew a "w" for each whistle; nine in each circle or package.)
Amy:	Belén (pseudonym) can you tell me about this story problem? (Belén hesitated.)

Amy:	Look at your sketching, what do you know about the story problem?
Belén:	We have three packages with six games in each and two packages with nine whistles in each.
Amy:	Who is going to be at this party?
Student:	Eight guests. (Amy sketched eight stick figures).
Amy:	What about the party boy, does the party boy get a bag too?"
Student:	Yes. (Amy adds a ninth person to the sketch and re-reads the question).
Amy:	We neglected to sketch the 27 candy bars. Somewhere there sketch 27 candy bars.

Amy had the class work with their shoulder partners to solve the problem. She told the class that she saw a clue word that told her what operation she was going to use to solve the problem. She asked the class if they knew what the clue word was. A student responded: "same." Amy: "If you are going to be giving the exact same number of something what operation is that?" Student: "division." Amy: "right, division because they need to be equal." Amy gave the students 10 minutes to work in their cooperative groups to solve the problem. She walked around to each group while students worked and helped where needed.

On another occasion Amy again went over a problem before having students solve it independently. The problem involved finding the perimeter of a rectangle. The rectangle was 18ft. by 20ft.

Amy:	What can you tell me about a rectangle?
Students:	The sides across from each other are going to be the same.
Amy:	The sides across from each other are going to be the same length. So if the bottom of the rectangle is 18ft. what is the top going to be?
Students:	18ft.

Amy: And if this side is 20ft. what is the other side going to be?

Students: 20ft.

As the students worked on this problem independently, Amy told them to underline the question and circle the important words. She reminded them that they had to show their work in order to get credit. Amy walked around the classroom and helped where needed. She said to one student who was struggling:" How many sides does this rectangle have?" Student: "Four." Amy: "So how many sides do you have to count?" Amy then reminded the students of the little rhyme about perimeter. She led the class in saying the rhyme: "For perimeter you add all sides, add all sides, add all sides, for perimeter you add all sides that's what we must do." After giving the students several minutes to work out the problem on their own, Amy solved the problem using the document reader. The perimeter of the rectangle was 76 feet.

Using journals. I asked Amy how frequently she used math journals and her rationale for their use. She replied that she is guided by the concept they are covering, some lend themselves better to being put in the journal. "But", she averred, "definitely, for sure at least once a day. At least once a day we'll put something in there." She views the journal as a study guide as it gives students a concrete way to store and review their new knowledge. They also serve to assess growth because she can compare the content with their learning later on.

> You can really see the difference. Like if they do a quick write at the beginning of a new concept and then at the end where they do a 3-2-1 protocol where they write three things they learned and two things they remembered you can see the difference. So it serves different purposes.

Making learning relevant. Amy uses students' background knowledge in teaching her students. She often begins with what they know, and proceeds from there. She tries to use things students are familiar with outside of the classroom.

Using students background knowledge. I asked Amy how she makes learning relevant to her students. She replied that she tries to use examples related to their lives or something that she knows they are familiar with outside the classroom. For instance when

she was teaching them about fractions, she used soccer balls, basketballs, and footballs because they are familiar to students since they use them in gym class. (e.g. when five of the balls are basketballs and two are soccer balls, what fraction of the balls are soccer balls?) "Those are items that are concrete and familiar to them so when they are dealing with fractions they can better understand it." She added that:

> If you know what their background knowledge is…then certain topics are easier for them to understand if you approach it from that aspect. Usually after you have had them for a while, you know their interests and you know things about them so you can think of something that's going to help them connect with the new information you are trying to teach them.

I asked Amy what she thought her most prevalent teaching strategy was. She answered that it is using students' background knowledge. She says she begins with what they know and proceeds from there. It has been a learning experience for her. She reported that she has found that she must first identify the students' level of functioning so that she can plan accordingly. This could require her to vary how she approaches a concept. "Taking what they know and running with it" is her most prevalent strategy.

Amy indicated that she learns about her students' background knowledge through doing activities like the write-ups and the quick-writes. "Having them write in their journals like that fraction activity…write everything you know about fractions. Because that's when I get an idea, OK, these kids they don't have a lot of background knowledge on certain things." Amy tries to activate their background knowledge as much as possible. If she knows that they are not going to be familiar with a topic, then she makes sure she has an activity that is going to give them some concrete examples of the concept. In such instances, she will often show a video or read a book about the concept. And when she is certain they do have some background knowledge, she uses an activity to activate that knowledge.

Prior school experiences are an important part of the background knowledge that students bring with them to school. Amy conveyed that the background knowledge that students have from other grade levels and the knowledge that they bring from home plays

a major role in what they learn in the current grade. She added that as in the case of telling time, students can move faster in third grade if their second grade teacher did a lot with them and they learned the basics in that grade.

Amy believes that the knowledge gained outside the classroom can make students appear "smart." She remarked that the students who have a lot of exposure to academic concepts have a greater level of knowledge about these subjects. "You see a student who appears smart because he has been exposed to a lot of things so he has a lot of prior knowledge. Some students seem smarter because of the exposure that they have outside of school."

Amy activated students' background knowledge prior to teaching them an introductory lesson on fractions. She had the students draw two concentric circles in their math journals with the inner circle labeled *fractions*. She called it a circle map. She had the students sketch or write about anything that came to their minds about the word *fractions*. She said "anywhere you have seen fractions can be in your circle map, at your house, at stores, anywhere." Amy gave them five minutes to complete the activity. After the time was up Amy invited students to share with the class what they had written about fractions. One student offered: "I drew a pizza and divided it into equal pieces." To which Amy responded:

> I heard him use the word *equal*. So definitely on your circle map I want you to write the word equal. The fractions that we are going to be learning about in third grade have to do something with the word equal.

Another student volunteered that she drew a pizza, divided it into fourths, and wrote ¼ on each section. A third student said: "I drew a circle and put a line through it to make halves." Students volunteered the words: same number, and parts. I later asked Amy about her goals for this activity. She replied that she wanted to see how much they knew about the topic.

Because that was going to guide my instruction the next day. If I'm seeing that they don't know a lot, then I have to reanalyze what I'm going to do the next day. Am I going to have to be more basic? Or am I going to be able to jump.

On another occasion, the class was working on a problem involving toppings on a baked potato. Amy asked the class what a baked potato was, for those who didn't know. Students volunteered that a baked potato was "food, and it's a potato and it's baked." She then asked the class to share what kind of toppings they liked on their baked potato. The class offered that they liked various toppings including butter, bacon bits, bacon, sour cream, chili, cheese, and olives.

I heard Amy using the word *schema* with her students so I asked her where their schema came from and why she used the word with her students. She explained that in reading they are learning about inference and the students learned that when they infer something they have to get textual evidence and use their schema. "They have to use what they already know from information stored in their memory and they put it all together and so they infer." Ever since that lesson she has continued to use the word schema. And her students like to use the word amongst themselves. "They want to use it all the time. They're like 'oh I got it from my schema.' That's why I use it, because it's something they took off with."

Amy used examples from students' real life to help make lessons relevant to her students. During a lesson on fractions, she asked the class if they had an example of something that equaled one whole. One student volunteered "five slices of pizza out of five slices of pizza equals one whole pizza." Amy added that if 22 out of 22 students met their accelerated reading (AR) goal, the whole class would have met their AR goal. And during a lesson on telling time, Amy asked her students what were some of the reasons why it is important to be able to tell time. Students offered: "To know when to get ready for school," "to know what time to go to sleep," "to know what time your mom is going to pick you up," "to know what time to get someplace," "to know what time to go to lunch," "and to know what time McDonald's closes."

Teaching through music, rhymes, movement, and visuals. Amy used at least two of these learning pathways during the lessons I observed (the pathways are music, rhymes, movement, and visuals). The two pathways that I observed most often were

visual and music and rhymes. She used memory aids to assist her students in remembering new information.

Using memory aids. Amy used rhymes and sayings and visual aids to assist her students' memory and provide a pathway for learning.

Rhymes and sayings. Like Eva, Amy used a familiar rhyme as a memory aid. In several instances during lessons on perimeter, Amy reminded students about the rhyme that they had learned. She asked one of the students to come up to the front and place the rhyme she had written in her journal under the document reader. Amy led the class in reciting the rhyme: "For perimeter you add all sides, add all sides, add all sides. For perimeter you add all sides, that's what we must do." Other teachers sang the rhyme to the tune of *Merrily We Roll Along* but Amy simply had students recite it chorally.

*Using visual aids***.** On two occasions during my observations, Amy had her class construct booklets to serve as visual aids in learning new concepts. The first was constructing a fraction book. After watching a video on fractions, Amy had students construct their own fraction book. The first two pages were titled "One Whole." The word *one* was written on one page and the word *whole* was written on the facing page. Amy passed out a paper fraction bar and instructed students to paste it into their booklets on the page titled "One" and had them write the words *fraction bar* on it. She then passed out a paper circle that students glued into their booklets and wrote the words *fraction circle* on it. Amy drew a pizza under the word "whole" and divided it into four pieces. She said: "What if I ate the whole thing? What if I ate four out of four pieces? How much pizza did I eat?" The students replied: "the whole thing." Amy had the students work with their shoulder partner to come up with a fraction that equaled one whole. One student asked if it had to be equal. Other students answered "yes." Amy asked if anyone wanted to share his or her example. One student came up to the document reader with her booklet and showed the class her drawing, a circle divided into eight equal parts. Under the circle she had written 8/8 or one whole. Amy directed the students to the next page in their booklets. She said: "the next page is one-half. We are going to cut the fraction bar

and the circle in half so now it's in two parts." The students glued the fraction bar and the circle into their booklets then divided them into two parts or one half. Amy pointed out that they were equal on both sides. While they were waiting for everyone to finish, Amy told her students to think of an example of one-half. She shared an example (i.e. half of her stickers were pink), using two stickers, she wrote 2 in the denominator since that was her total. One of her stickers was pink. Amy directed her students to work in their collaborative groups and think of an example of one-half. They were instructed to label the denominator and the numerator. One student said, I have 4/8ths as the same as ½. Amy replied, "Yes, but make it ½ or one out of two." Amy told her students that she would go around and check their work.

On another occasion Amy had her students make a geometric shapes booklet. She handed out a blank sheet of copy paper to each student and led the class through a paper-folding activity to create different geometric shapes. She directed the students to fold the paper in half vertically. "The bottom is going to meet the top exactly." Amy then had them unfold the paper and asked what they noticed about the top and bottom of their paper. Students responded that they were both the same size and same shape. Amy asked them what geometric shapes they had created. Students responded: "a rectangle." Next Amy directed the students to fold the top corner down diagonally like a paper airplane.

Amy:	You are going to fold your paper diagonally, that is a diagonal fold. (She instructed them to share the fold they just did with their cooperative group partners).
Amy:	José (pseudonym) what kind of fold did your cooperative partner say we just folded?
José:	A diagonal fold.
Amy:	What two geometric shapes do you have now?
Student:	A triangle and a rectangle. (Amy continued to lead them through folding and cutting their paper until they had six geometric figures in a row in front of them.)

Amy: Now I want you to look at the shapes that are in front of you. Which of these geometric figures in front of you are the same size and same shape?

Student: The skinny rectangles.

Amy: You are correct. Are there any other shapes that are the same size and shape?"

Students: The triangles.

Amy: These shapes that are the same size and same shape are congruent figures. That is the academic language that we are learning this morning. If something is the same size and same shape they are congruent. I want you to share in your cooperative group what congruent means. Mr. Avila (pseudonym), could you share with us what someone in your cooperative group told you about congruency?

Mr. Avila: That the shapes have the same length and width. That the shapes are both the same size and same shape.

Following Amy's instructions, the students wrote the definition of congruency on the first page of their geometric shapes booklet and then sketched two figures that were exactly the same size and same shape. She sketched two congruent rectangles in her booklet. She asked the class for other examples of congruency she could draw. The students responded that the triangles in their folded paper were congruent. Amy directed the students to draw either rectangles or triangles as examples of congruency in their geometric booklets.

Amy used videos as another type of visual aid with her students. When asked why, she explained that some concepts are more difficult for them to grasp and a video provides concrete representations of abstract concepts. For instance, telling time is a difficult concept for some of her students to grasp. "Especially the quarters" she said.

"The video helps them see time being broken down into pieces so they are able to understand it better."

Amy prompted her students to use sketching as another visual aid to solving problems. When they worked as a class on a problem on a activity sheet, they used sketching as a strategy to find the solution. For example: "Michael's note book has the names and addresses of his friends. He has room for eight names per page." How many friends can Michael fit on eight pages?"

Amy:	How can I sketch this question?"
Students:	Sketch an array. (Amy sketched an 8 x 8 array).
Amy:	So how many names can be put on these eight pages?
Students:	64.
Amy:	Does anyone disagree with that? What are some other ways you could find the answer?
Students:	By sketching the eight pages and writing in the eight friends on each page.

Amy also encouraged students to use sketching as they were solving activity sheet problems individually. For instance, one student struggled with the question: "Mary used four tacks to hang a picture. How many pictures can she hang using 12 tacks?" Amy told her to use sketching to solve the problem and the student drew three pictures with four tacks each to find the correct answer.

Collaborative groups. Amy related that students work in collaborative groups so they can help each other. She believes that they are more comfortable with their peers in discussing classroom concepts. She shared that at times students are more comfortable asking each other questions than they are asking her. Amy added that in the real world students will have to work with people. She conveyed that they engage in classroom talk with each other which allows them to practice the new academic vocabulary they are learning. Amy believes that it is less stressful for the students when they work in cooperative groups. She shared that students tend to be harder on themselves when they

work with her, but in their cooperative groups they are more relaxed. She remarked that for the most part it is a positive experience academically and socially. But she added that she has to be strategic about how she places students together and who is allowed to work together. In cooperative grouping "you can always tell who has issues socially because they always end up without a partner. And it is always the same two children." When she groups them arbitrarily students always have a partner. But when she does "stand up, hands up, pair up," the same two students are left out without a partner. Amy shared that one student in particular needed social skills. He appeared to engage in inappropriate behavior just to annoy other students in his group. For example, he would pick his nose and try to wipe it on his cooperative partner. The other students are "grossed out" by this behavior. Most of the students want to get in their cooperative groups and they want to work and they want to get good grades, so they are intolerant of this student's behavior.

Amy uses collaborative groups to meet the needs of different students in her classroom. She related that she can have different groups work at different levels. She does this by sometimes putting students together by ability. Sometimes she groups low achieving students so that she can work with them, and she groups high achieving students so she can challenge them. But most of the time she groups heterogeneously so they can help each other.

Amy used some form of collaborative learning in every session that I observed. Sometimes it was simply for students to check their work with their shoulder partner. Other times it was to do a group project. She would often tell students that if they had a question they should first talk it over with their collaborative group members before asking her. She reminded them that they had collaborative groups so they could learn to have classroom talk and learn to solve problems together.

Students worked in groups on a problem on a activity sheet that talked about a baked potato. Amy led the class in activating their background knowledge about what a baked potato was and their favorite toppings on a baked potato. The problem had a table showing what boys liked on their baked potato and a bar graph for showing what the girls

liked. Amy asked: “Mariana (pseudonym) how many girls like butter only on their baked potato?” Mariana: “six.” Amy asked the class how Mariana got that answer. A student volunteered to come up and point out the 6 on the bar graph. Amy: “What about butter with sour cream?” Students: “four.” Amy:

> Before you get to your question it is important that you understand the information that they are giving you. You’ve got to check your comprehension just like we do in reading. If you don’t know what they are talking about you are not going to be able to answer your questions. I’m going to go through the questions then I’m going to let you answer them in your cooperative groups.

One question was: How many boys liked butter only on their baked potato compared to girls who liked butter only? Amy asked the class what it meant when the question said “compared?” The students answered:” subtraction.” Another question was: What was the least favorite topping of both boys and girls? Amy: “What does “least” mean?” Student: “The ones that are the lowest.” Amy gave the students 15 minutes to work the problems in their collaborative groups. She said:

> If you have questions first discuss it with your cooperative group members and then if you still don’t get it then you can ask me. That’s why you have cooperative groups. You are learning to have classroom talk, you are learning to solve together.

The students worked in their collaborative groups. Amy walked around the classroom and helped where needed. When groups finished their problems early, they drilled each other on their sevens multiplication facts.

Motivation and engagement. Amy tries to motivate and engage her students as part of her program for successful teaching in mathematics. Two of the means by which Amy motivates and engages her students are positive reinforcement and playing games.

Positive reinforcement. I asked Amy how she challenges her students to do their best work. She replied that she uses constant positive reinforcement. She tries to teach them to take pride in their work; to take pride in what they do. I asked her what she meant by positive reinforcement. She answered that she may use a “high five” or call their

parents with positive news of something the student did. She said the students like it when she calls their parents. She also offers her students tangible rewards for doing well. For example, she offered students a pizza party if they met their accelerated reader (AR) goals. She also might offer them some free time for meeting goals or doing a good job.

Playing games. The "around the world" game that Amy plays with her class in math motivates students to learn their multiplication tables. That the game was motivating to students was evidenced by the fact that students voluntarily practiced their multiplication tables when they had a few minutes before class began. Students were also motivated when they could share what they had written in their journals. For example, when students wrote anything that came to mind about fractions, there were many students that raised their hands eager to share.

Supports for struggling learners. Amy offered several types of supports for struggling learners in her classroom. They were: working with students individually, differentiating instruction, and working from the more basic to the complex.

Working with students individually. Amy reported that the majority of her students are on grade level in math. I asked Amy how she works with those below grade level and she replied that "it's a lot of one to one. It's a lot of redirecting, a lot of checking for understanding, a lot of giving explicit instruction again." She targets students who struggle during whole group instruction by directing questions at them. She gives them more concrete examples. She indicated that she will introduce a topic to the whole class, and when the majority of them are working on their own, she will sit with the one or two students who are struggling. I observed that Amy frequently sat with one student in particular who needed a great deal of help during math class.

I asked Amy how often she tries to work with struggling students individually. She replied that her approach varies. If she is walking around the classroom and sees someone who is struggling then she tries to focus on that student. She commented that it seems that it is always the same students. She conveyed that her conference periods were often occupied with meetings and other pressing matters, so she doesn't have the time to

meet with them individually as often as she would like. Amy related that: "most of the time it's just when I am walking around the classroom and I see someone struggling, it's just right then and there." If a bigger group appears to be struggling, she might keep them while the rest of the class goes to the library. If three or four students are involved, she tries to work with them during a pull-out time such as physical education (P.E.) class.

Differentiating instruction. Amy differentiates instruction to fit students' needs. Most of the students in Amy's room can do problems in written form. But she has one or two for whom she has sketch the problem prior to their solving it. For example, for the problem *15-7* these students still need to sketch the 15 ones and then ask themselves, "can I take seven away?" Also with the number lines in subtraction, most of her students can count by 100s. But she has one or two who still count by 10s.

Amy shares that she is always looking for an alternative with her students who struggle. If something doesn't work for them, she tries to find something that does. She said that it is helpful to have open communication with various people who can help her such as teachers who have worked with that student in previous years, or teachers who have worked with similar students. She relies on their collaboration.

> It's a lot of team work. It's because I don't have all the ideas, I don't have all the answers. I've been very grateful that for the majority of my teaching career I've had the opportunity to work with professionals who are team players.

Working from the more basic to the complex. Although Amy did not have any students with math disabilities in her classroom while I observed, I asked her how she generally works with students who have math disabilities. She explained that she begins with more basic concepts and works up to the more complex. For example, when learning place value, some students still need to manipulate the base 10 blocks. During instruction, she tries seat these students where they can be closer to her. She shares that it takes a lot of thought to work with students with special needs. She has to think about where to place them in the classroom, who she is going to place them with, and how to scaffold instruction for them. She confirmed that she has to use more scaffolds for these students

even during whole group instruction to try to make learning more accessible in spite of their disability. Frequently, while the majority of her students work independently, she sits with her students with learning disabilities to provide the individualized attention they need. She also uses some of her conference periods to individually tutor those students. Amy shared that it is difficult to tutor a child with learning disabilities. She says she has to make a lot of time and be strategic in everything that she does.

SARAH

Personal and Professional Background Information

Sarah (pseudonym) teaches fourth grade at Gonzalez Elementary School (pseudonym). She was born and raised in California but has lived in the Rio Grande Valley of South Texas for the past 25 years. She reported that her family was middle class while she was growing up. Her father worked as a foreman for a local housing authority doing repair work for 40 years. Before Sarah started teaching she worked as a child protective services (CPS) case worker. Before that she was a gang intervention counselor. She felt that she was pretty successful at CPS but due to all the bureaucracy and paper work, she decided to look for other employment. She had initially considered teaching middle school since that was the age group she had experience with however her supervisor at CPS suggested that she needed to intervene earlier, as in fourth or fifth grade. She enrolled in an alternative certification program (ACP), completed her elementary certification and started teaching. She has been teaching fourth grade for 9 years all at Gonzalez Elementary School. Sarah likes fourth grade because of the challenges. Many new concepts are taught in fourth grade, especially in math. Sarah

identifies herself as Mexican American and is fluent in speaking, reading and writing both English and Spanish.

Perceived effectiveness of pre-service and in-service training. Sarah disclosed that her pre-service training did little to prepare her to work with special groups of children such as students with gifts and talents (GT), learning disabilities (LD), English language learners (ELL's), or those from lower socio-economic status (SES) backgrounds. She reported that the ACP included 12 hours of elementary education but did not address special groups; they just targeted the average learner. Sarah reported that her previous CPS training and experience helped her understand how to work with students from low-income backgrounds. She had many students from poor families during her first year of teaching and she said she didn't have any problems with them. Half of the class didn't speak English very well and the other half was fluent in English. But at the end of the year they all tested in English and did very well. The students put a lot of effort into it and the parents were very helpful. Sarah said that it has mostly been through hands-on learning and learning from co-workers that she has been able to succeed with different groups of students. Sarah shared that the district has provided some in-service training in the last few years for teachers with ELL students. In that training, they emphasize how to transition students from Spanish into English. If a teacher has students whose primary language is Spanish, the district will train them with the Dual Language program. Sarah reported that out of her 26 students this year, she has eight or 10 who are designated as ELL's. But she claims that their primary language is English. She has one who speaks mostly Spanish, but the rest speak English very well.

Views On Teaching.

I asked Sarah about her views on teaching. I specifically wanted to know her philosophy of teaching, what she likes best and least about teaching, some of the positive and negative interactions she has had with students, and some of the challenges she faces.

Philosophy of teaching. Sarah's philosophy of teaching is that teaching is not just about math, reading, and grammar, rather, it involves teaching students how to be

students; teaching students about life. She says: "If you can combine that with reading or math you give the students something that they can relate to. I think you will be a more successful teacher. It's not just about math and reading." Sarah tries to teach her students about real life situations dealing with money. This would include things like how to go shopping with a fixed amount of money and making a rent payment or a car payment. It also includes discussions regarding the earning potential for a person at McDonalds or a teacher or a lawyer. She said the students were stunned. They didn't know. Sarah says she does that frequently, "so they can see it. It's there in black and white."

What Sarah likes best and least about teaching. What Sarah likes best about teaching is that there is a new challenge every day.

> Every day is a different challenge. I can't come into work and do the same thing like I used to with CPS…it's always changing. It's always one thing or another…there is never a dull moment, it is different every day.

A second thing Sarah likes about teaching is when she sees her students "get it;" when she sees that "light bulb go on." That's very rewarding to her. Sarah shared the story that one of her students who frequently struggled scored 100 percent on a math test. "Everybody clapped for him. It is very rewarding when that happens."

What Sarah likes least about teaching are the administrative duties and the repetitiveness in the paper work. She related that she will turn in a piece of paper and then have to "turn around and turn in another piece of paper that is the same thing except for one little line is checked off." She said she spends more time with the paperwork than planning her lessons. The administrators are constantly asking her which students are going to pass so she has to keep up on her grades. Every two weeks at a minimum she has to have grades turned in. She said it is very repetitive and it takes a lot of time. Another area she is concerned about is the curriculum. This comment specifically refers to the math program, CSCOPE (not an acronym, CSCOPE is a K-12 educational curriculum support system that has been widely adopted in Texas. It was created by the Texas Education Service Center Curriculum Collaborative), she said she didn't think the

curriculum was written by teachers. She believes that the authors of the curriculum have been out of the classroom for too many years. She claimed that "they need to go back to the trenches and work with a teacher every so often."

***Positive and negative interactions*.** A positive interaction that Sarah has had with her students concerned a booklet for measurement that they were making in math. The booklet consisted of 5 x 7 note cards on which the students had written different measurements with illustrations and stapled together. Sarah reported that the students have really liked making the booklet and they are taking their time with it and are doing a neat job. Sarah affirmed that she has a very good relationship with her students. Each new school year though starts out "rough" with both students and parents as they learn the new routine. She added that it was worthwhile when at the end of the year a student said: My mom said she wished more teachers were like you because you are strict." She affirmed that parents have come to her and said: "Thank you very much. I thought you were like, mean." But Sarah clarified, "I'm not mean. They're mistaking strict for mean. And they [the students] come out pretty good."

A negative interaction she related involved two students who would come to class every day and who would disrupt class by kicking their chairs and crying. This occurred almost every day. Various behavior management techniques seemed to be of no benefit. She requested that a Special Education evaluation be carried out with these two students. This resulted in the disruptive students being removed from her room. She said "there has to be something done when it's a disruptive student kicking desks. It's very hard." Sarah conveyed that she doesn't have much in the way of negative interactions with her students. Usually when a student displays problem behaviors she is able to redirect their behavior. She stated that she rarely sends students to the principal. I noted during my observations that she responded quickly to problem behaviors and they did not cause any major difficulty.

Challenges. Sarah indicated that one of her greatest challenges is the student who seems uninterested and consequently doesn't try and it doesn't seem to matter how much

fun she tries to make it for them. This is reflected in the grades and parents are sometimes disappointed. Parents may believe that their children are functioning at a certain level and when they see the grades, there can be a lot of disappointment. A related challenge that Sarah identified is the wide range of students in her classroom.

> From socio-economic statuses to language barriers…there is a big range and it is not difficult to pick out who is going to struggle. Each student comes with a different challenge. Every one of them is different. So it's a challenge in itself.

A final challenge Sarah shared is that the students are becoming more and more difficult every year. "They are more grown up. What junior high school students were like a few years ago, these students are like that now, especially in regards to peer pressure."

Views Concerning Students and Parents

Sarah shares her life with her students and encourages them to share their lives with her. She stated "I pay attention to a lot in my student's life. I like to learn from them. It's funny sometimes the stories they will tell. But you get to know them pretty good." She said that the stories her students tell her indicate to her that there is a lack of direction and nurturing at home. She feels that students are raising themselves. "You just pay attention to them, to what they say, and you learn a lot."

Sarah cited a supportive team as one reason she is successful. She says the other fourth grade teachers are very supportive and they have a great team. They are always on the same page and they help one another out. If students cannot understand something with her then she will switch students with another teacher. She feels that possibly a better fit between the student and teaching methods may be able to be found. She and the other teachers share ideas. "It's not just my kids or her kids it's our kids." She said that another aspect of success is making math fun for the students. "They love my math. I mean we will come up with little songs for the perimeter and area so it's not just drill, drill, drill."

There are a number of characteristics of a successful student according to Sarah. Attentiveness, intelligence, and a desire to learn were mentioned. She shared that she has

a particular student who is quite intelligent and who learns quickly but has a hard time focusing on the work and therefore gets very little done. However, he is able to perform well on tests and is one of Sarah's best students and makes some of the highest grades in the class.

According to Sarah, the characteristics of struggling students include the lack of desire to learn, lack of ability, immaturity, and lack of focus. Sarah has one student in particular who has difficulty staying on task. Attendance is a problem and her mother is not supportive in keeping up with her work. Sarah said: "She takes beautiful notes but she doesn't apply any of it. If there are steps to a problem she will only do half of them. She will just give up on it." Sarah tells her that "I don't have fairy dust. There is only so much I can do."

What students need most to be successful. Two characteristics that Sarah mentioned that students need to be successful are structure and consistency. School should be a place where students go to learn, not to play. Sarah named Japan and China as two countries where education is taken more seriously than in the U.S. She stated that they are very disciplined there and she thinks that that is what is lacking here. She reiterates "As a teacher you try to provide that basic discipline but you're not there 24/7. They go home and they come back and you have to start all over again." She tells her students that it is up to them. They could be a doctor or the president if they have the structure and consistency.

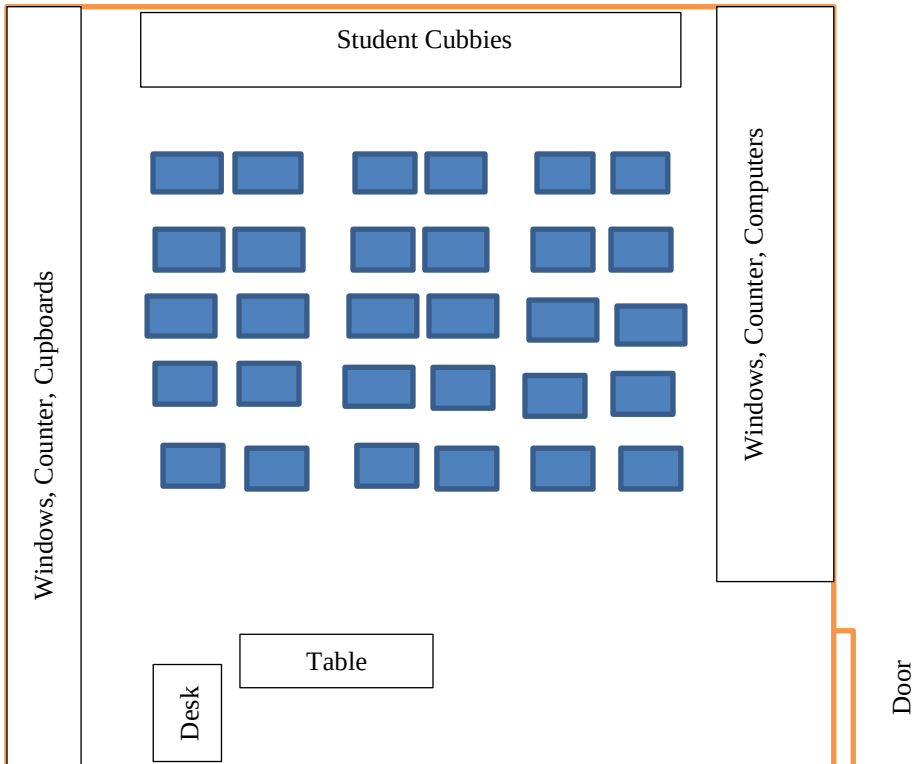
Sarah expressed that the three most important things students could learn is preparation, determination, and self-discipline. They need preparation in the basic skills in reading and math that will prepare them for future careers. And they need the determination to make something out of themselves. They need to go beyond graduating from high school, to establish goals and determine that they are going to reach those goals. Sarah shared that sometimes she is disappointed in the lack of self-discipline in some of her students. She said that "to them school is like a big joke." And most of them

need the self-discipline to manage their time well. Sarah declared that "they need to manage their time so that they have the time to do some reading most every day."

Working with parents. Sarah related that she has had very little in the way of parent involvement this year. She said that she has about three parents who are involved in their children's education. She does call parents however when students grades are low. The parents generally respond favorably when she calls them. In years past when she has had difficulties with students, she has had parents come in and spend time with their child. The parents have been good about coming in when she has asked them. However, she added, parental involvement has been declining over the years.

Sarah doesn't assign homework for her students. She gives them the opportunity to finish their work during class but if they play around and they don't get it done then it's homework. Sarah doesn't like to give students homework because she perceives that because of their socio-economic status students face uncertainty at home. Because parents often work until late in the evening they are unable to help their children with homework so she relieves some of the stress by not assigning homework. It is less stressful for the students and less stressful for her because she doesn't have to give them zeros and be angry because they didn't do their homework.

Sarah stated that because some of her students lack discipline at school, she believes they also lack discipline at home. Sarah utilizes a more traditional approach to discipline. For example, she said that at the first of the year there were some students who



Students' Desks

Figure 3: Sarah's Classroom.

spoke disrespectfully to her. She had these students turn their desks around and face the wall and copy out of the dictionary until they were ready to write a letter of apology and turn around and join the class. She said that if they're not getting discipline at home they have to get it somewhere.

A Typical Mathematics Lesson in Sarah's Classroom

In the following section I put forth the features of math instruction Sarah utilized in her classroom. I begin with the classroom context of an average day in Sarah's math classroom. I then go on to advance the aspects of her math instruction that she used on a regular basis. Sarah used a wide variety of strategies to teach math to her students.

Sarah's classroom.. As I entered the room students were transitioning from English language arts to math. They were putting away their reading books and getting out their math journals. Sarah was straightening papers at her desk and getting her math supplies ready (a diagram of Sarah's classroom is in figure 3). Standing in the doorway, to my left is the smart board screen that takes up the center portion of the wall and covers a white dry erase board. On either side of the smart board screen are bulletin boards. One bulletin board is empty. The other is positioned over Sarah's desk and holds calendars

and notices. In the corner sits Sarah's desk. Her desk holds her computer and papers. In front of her desk is a table where a student sits. The table also holds the document reader. To my right is a book shelf that holds dictionaries and encyclopedias. Further down the wall to the right of the book shelf is a counter top that holds four computers. Above the computers three wide windows look out into the hallway. Student's cubbies are along the back wall. They hold students books, backpacks, papers, and sweaters and coats. On the shelf above student cubbies are math books. In front of me is a wall that contains several large windows that look outside. Below the windows is a counter top that holds various items such as boxes and books. Below the counter are cupboards. The student's desks are arranged in pairs and fill the center of the room.

I observed Sarah on eight separate occasions. The following observation was chosen because it is representative of what I observed across all lessons. Sarah began the day's lesson by reviewing the rounding of whole numbers, a concept that was taught the previous day. She wrote the number 1,693 on the smart board.

Sarah: If I was rounding to the nearest hundred, what is the first step I would do?

Students: Underline the hundreds place value. (Sarah underlined the six.)

Sarah: What is the second thing I need to do?

Students: Circle the nosey neighbor.

Sarah: In this case who is the nosey neighbor?

Students: The nine. (Sarah circled the nine).

Sarah: What is the nine telling the six to do?

Students: The nine is telling the six to change to a seven and everything to the right becomes zeros.

Sarah: So we have covered rounding of regular whole numbers.

Sarah then told the class that they were going to learn about rounding decimals. They were going to be rounding to the nearest dollar. Sarah gave them the example of *$3. 14*. She asked the students what the whole number was. The students called out together

that it was the three. Sarah added, "yes, my dollars." Sarah asked the class what the numbers to the right of the three were. A student called out that they were the change. Sarah: "right, my pennies' my nickels, my quarters, my change." Sarah asked the students what number would change if she rounds to the nearest dollar. The students called out together that the three would change. Sarah said: "a lot of you can help your parents when you go grocery shopping doing this." Sarah reminded the students that they could round either by using both numbers or just one. The students said they wanted to use both numbers. Sarah circled the 14 and said "when you use both numbers its 50 and up bump it up and 49 or less let it rest." So in this case, Sarah asked, what happens to the three? Students: "it stays the same. So the *$3.14* becomes *$3.00*." Sarah directed the student's attention to a handout that she had given them earlier. The handout concerned rounding money. The first problem was *$58.05*. Sarah: "Which number do we change?" Students: "the 8." Sarah: "So what happens to the 8 in this case?" Students: "it stays the same. So *$58.00*."

Sarah then called individual students to come up to the board and work on rounding to the nearest dollar. The first problem was *$7.76*. Sarah asked the students what they needed to do. The students called out together that you underline the seven in the dollars place and circle the "nosey neighbor" or the seven in the tenths place. The student at the board circled the seven in the tenths place then rounded the number to $8.00. Two more students came to the board and worked problems rounding to the nearest dollar.

Sarah asked the class if they were ready to go shopping. They answered "yes" in chorus. Sarah: "You are going to go shopping with the person you are sitting with" (their desks were arranged in pairs). Sarah gave a Walmart flyer advertising Halloween sales to each pair of students. The flyer advertised mostly food and candy items. The students were instructed to work together and round items to the nearest dollar. Sarah gave each pair of students a hypothetical $100.00 to spend. The students were to work on grid paper. They wrote *item*, *amount*, and *round* in each of three columns. Sarah showed the

students an example from the flyer (apple cider for $4.48) and worked the example on the board. She underlined the four in the dollar's place and circled the four in the tenths place. Sarah: "five and up," students: "bump it up." Sarah: "four or less," students: "let it rest." She wrote $4.00 on the board. "Now", she said, "I have $96.00 to spend." As the students worked, Sarah walked around the room and asked groups of students: "How are you doing?" She checked students work and helped them as necessary. The students were engaged in the activity. One student said: "I now have $89.08." Sarah replied: "you shouldn't have any cents if you are rounding. You did something wrong if you have any change." Sarah: "Remember you can't go over $100.00." The students continued to "shop" until the end of the period. Towards the end, one pair of students "won" by being the first to reach zero, viz. spend all their money.

Features of Math Instruction Utilized by Sarah. Sarah used a variety of instructional strategies to teach her students. The following patterns or themes were derived from all observations combined and they represent the most frequently occurring features of Sarah's math instruction. The strategies include: reviewing previously learned concepts; making learning relevant; teaching through music, rhymes, movement, and visuals; collaborative group work; motivation and engagement; monitoring progress and understanding; and supports for struggling learners.

Reviewing previously learned concepts. At the beginning of each class period that I observed, Sarah reviewed what they had been working on the previous day. During one session, for example, she had students turn to a page in their *Motivational Math* workbook. She asked the class which problems they had difficulty with. Students said "number seven" (the problem was *94x2*). Sarah wrote *94 x 2* on the smart board. She asked the students how many of them preferred to work vertically. Most students raised their hands. Then she asked them how many preferred to work horizontally or the area model. A few raised their hands. Sarah reminded the students that they had to work by steps. First multiply 2 x 4 then multiply 2 x 9. She drew arrows from the two to the four then from the two to the nine. The answer was 188. Sarah: "ask yourself, did I multiply

the top number by the bottom number. If you did then you are done." For those who liked the area model, Sarah asked how she could break up the 94 to make it easier. The students said 90 + 4. Sarah put the 90 + 4 on the board and drew a rectangle under it. She divided the rectangle at the + sign to make two rectangles.

Sarah: The first thing I'm going to do is multiply the 2 x 90. Do I have any trailing zeros?

Students: Yes. (Sarah wrote a 0 in the square below the 90).

Sarah: OK, what's 2 x 9?

Students: 18. (Sarah wrote 180 in the first square).

Sarah: The next thing you do is multiply the 2 x 4.

Students: Eight. (Sarah wrote an eight in the second square. Then she added the 180 + 8 for a total of 188.)

The next problem identified as difficult by students was *53 x 7*. Sarah asked the class what they could do if they didn't know their seven's multiplication table. The students replied that they could draw a chart. Sarah drew a chart of multiplication by sevens on the board.

Sarah: The first thing to do is to circle the number you are going to multiply by. (She circled the seven).

Sarah: What is 7 x 3?

Students: 21. (Sarah put the one beneath).

Sarah: What should I do with the 2?

Students: You carry it. (Sarah carried the 2 and circled it.)

Sarah: Why should I circle it?

Students: So you didn't get confused as to which number you are working on.

Sarah: Right, and after I use it what do I do with it?

Students: You fill it in.

Sarah: What is 5 x 7.

Students: 35.

Sarah: What do I do next?

Students: Add the 2. (Sarah added the 2 to 35 to make the answer 371).

Sarah: Have I multiplied the 7 x 3?

Students: Yes.

Sarah: Have I multiplied the 7 x 5?

Students: Yes.

Sarah: Did I already use the 2?

Students: Yes.

Sarah filled in the circle around the two. Sarah then called on a student to come up to the board and wok the problem *73 x 7*. The student worked the problem without difficulty.

The following is an activity Sarah did with her class to review previously learned concepts about measurements. After reviewing measurements by having students relate measurements to things commonly found in their environment, Sarah had the students do a scavenger hunt in the classroom. She told the students that for the scavenger hunt they were going to do two things. One they were going to work in pairs to find objects and they were going to estimate the length. And two, they were going to find an example of the actual measurement. For an example she held up a notebook.

> She is going to estimate that the notebook measures one foot. Then she is going to find something else that actually measures one foot. So you are going to do two things. You are going to find the estimate, and then you are going to find the actual measurement.

Sarah assigned each group a unit of measurement. She gave some groups the measurements using the U.S. standard whereas others received metric measurements. They had to find three examples of their assigned measurement. Sarah handed out pieces of paper that the students folded in half. On the top half they wrote the word *estimate* and on the bottom half they wrote the word *actual*. They then worked with their partner to find their measurements. Sarah mingled with the groups and asked them questions as they worked. She asked questions such as: "What is the actual length? What did you get?

Would that be estimate or would that be actual? What are you finding? Show me what you are measuring." After the students finished measuring, they presented their findings to the class. The first pair of students who were assigned centimeters shared the tip of a crayon and the metal band around a pencil as their examples of actual measurements. They used the square on a grid paper as an example of an estimate of a centimeter. A second group showed a paper clip and an eraser as an actual inch. The top to a marker was their estimate of an inch. After the activity was over and all the groups had a chance to share, Sarah directed the students to take out their *Motivation Math* workbooks and work in those to the end of the period.

Another strategy Sarah used was a activity sheet activity that reviewed previously learned concepts that the students were having difficulty with. She said "a lot of you are still having trouble with your trailing zeros." Sarah put a activity sheet under the document reader. The first problem was ____ x 100 = ____. "In this problem, how many trailing zeros do you have?" Students: two. Sarah put two zeros in the answer line. The answer choices were:

1. 9 and 90
2. 90 and 9,000
3. 900 and 900
4. 90 and 900

Sarah took the class through each answer choice. The answer was 2, 90 and 9,000. Sarah admonished her students that the next one they got wrong because they did not read the entire problem. "How many of you put 1,200?" Several students raised their hands. "That's because you didn't read the whole problem." The problem was: "The ranch hands at Bar S ranch put fence posts into equal stacks. The table below shows you how many posts were in 9, 10, and 11 stacks. How many posts were in 13 stacks?"

Number of stacks	Number of posts
9	900
10	1,000

11 1,100

The answer was 1,300. The next problem was: “What number makes this equation true? ____ x 100 = 8,000?” The answer choices were:

1. 8
2. 80
3. 800
4. 8,000

Sarah: “How many zeros do we have?” Students: “two” Sarah: “So how many zeros do I remove from my answer?” Students: “two.” Sarah crossed out two zeros in 8,000. Sarah: “So what’s my answer?” Students: “80.” Sarah worked several more problems having to do with “trailing zeros” on the activity sheet under the document reader. She then moved on to a different type of problem. One problem was: “The numbers in set G are paired with the numbers in set H. The numbers in set G were 4, 5, 6, and 7. The numbers in set H were 24, 30, blank, and 42.” Sarah drew an arrow from set G down to set H. She said: “Which equation shows how to find the number in set H that is paired with the 6? The numbers in set G are smaller than the numbers in set H. So what do I do?” Students: “addition or multiplication.” The answer choices were:

1. 6 x 5
2. 6 + 6
3. 6 + 35
4. 6 x 6.

Sarah: What do you do to the 4 to get 24?

Students: Multiply by 6.”

Sarah: Multiply by 6. But before I write anything in there I want to do the next one because I want to see a pattern. What do I do to the five to get 30?”

Students: Multiply by 6.

Sarah: So far so good. But just to make sure let's do the last one. What do I have to do to the number 7 to get 42?

Students: Times 6.

Sarah: So the answer is 6 x 6.

Using activity sheets. Sarah frequently used activity sheets to review and practice previously learned material. They would generally work on these activity sheets step by step as a whole class. She would also occasionally give students problems on the activity sheet to do on their own. During one of my observations they were working on a activity sheet as a whole class. Sarah led the students through the activity sheet by asking them questions. One problem was: "Mr. Ryan is buying gloves to donate to the school this winter. The gloves come in packages of two pairs. How many pairs of gloves will Mr. Ryan have if he buys 10 packages?" Sarah said to her students: "How do I solve this problem?" The students replied: "2 x 10 = 20." The answer was 20. The next problem was:

Mrs. Edwards was lining up chairs for the choir program. The table shows how many chairs would be in several different numbers of rows.

Number of rows	Number of chairs
4	36
5	45
6	54
7	63
8	

"Based on the pattern shown in the table, what should Mrs. Edwards do to find the number of chairs in eight rows?"

Sarah: The numbers go from left to right and get bigger.

Sarah: "So what should we do?" Students: "add or multiply." The answer choices were:

1. Divide 36 by 5

2. Add it to 63

3. Multiply 8 by 9

4. Subtract 9 from 63

The students found the answer to be 3, multiply 8 by 9.

The students worked the next problem independently. This problem differed from the previous one in that the students were to use division to solve it. The problem was: Raven used the table to find the ounces of popcorn in different numbers of containers. Based on the information given in the table, how many ounces of popcorn are in one container?

Number of containers	Ounces of popcorn
4	80
8	160
12	240
16	320

Sarah: "Do the work. Come on let's go." Sarah walked around the classroom and helped individual students as needed. Sarah told the students she had only seen one student get the work right. They all got the answer correct, but only one student worked the problem using division. She told the students they had multiplied where they should have divided. In this problem the numbers were easy, but Sarah warned them that if the numbers were harder they would have to divide to get the correct answer. When this activity sheet was complete, Sarah passed out another activity sheet for the students to work on independently. "But," she said, "be ready because I'm going to be calling on you to come up and explain. You are going to be the teacher.

Working on the board. Sarah often worked on the board to model new concepts and to review previously learned concepts. After reviewing *two digits* by *one digit* multiplication, Sarah moved on to *three digits* by *one digit*. Sarah wrote on the board: *265 x 7*.

She said: “It’s the same process, the same thing. The first thing I’m going to do is circle the 7. That’s what I’m multiplying by.”

Sarah: 5 times 7 is what?

Students: 35.”

Sarah: What do I do with the 3?

Students: Put it above the 6.

Sarah: And put a circle around it. What is 7 times 6?

Students: 42.

Sarah: What do I do with the 3?

Students: Add it to the 42.

Sarah: So we have 45. What do I do with the 4?

Students: Put it above the 2.

Sarah: And circle it. What’s 7 x 2? What do I do to the 4?

Students: Add it to the 14.

Sarah: So what do I have now?

Students: 18

Sarah: So the answer is 1,855.

Sarah next did the area model on the board with the same problem *265 x 7*. Sarah asked the class how she could break down 265. The students replied 200 + 60 + 5. Sarah drew a rectangle below the 200 + 60 + 5 and divided it into thirds at the plus signs. She then demonstrated how to work the problem using the area model.

In another instance, Sarah reviewed *two digit* by *three digit* multiplication on the board. She had the students suggest problems to be solved. The first problem a student suggested was *836 x 34*. Sarah showed the students how to work the problem using the area model. She wrote on the smart board 800 + 30 + 6 x 30 + 4. She drew a rectangle below the 800 + 30 +6 and divided it into thirds at the plus signs.

Sarah: The first figure is 800 x 30. How many trailing zeros do I have?

Students: Three.

Sarah: 3 x 8 equals what?

Students: 24.

Sarah: So the answer is 24,000. The second area model would be what?

Students: 30 x 30.

Sarah: Very good, what is 30 times 30? There are two trailing zeros and 3 x 3 is what?

Students: 9.

Sarah: So the answer is 900. What is the next one?

Students: 30 x 6.

Sarah: How many trailing zeros?

Students: One.

Sarah: What is 3 x 6?

Students: 18.

Sarah: So the answer is 180. What is the next one?

Students: 800 x 4.

Sarah: How many trailing zeros?

Students: Two.

Sarah: What is 8 x 4?

Students: 32.

Sarah: So the answer is 3,200. What is the next one?

Students: 30 x 4.

Sarah: How many trailing zeros?

Students: One.

Sarah: What is 3 x 4?

Students: 12.

Sarah: So the answer is 120. What is the last one?

Students: 6 x 4

Sarah: 6 x 4 is what?

Students: 24.

Sarah; So add up all the answers and you will have the answer to the problem.

Sarah indicated that when she is introducing new information to students, she will usually model it on the board for two days. Then students will practice it together for two days, after that they are generally able to work independently. “So it’s really a little process. It’s a lot of modeling and then it’s a lot of togetherness, after that, it’s OK, you can do that on your own."

Making learning relevant. Making learning relevant to students was important to Sarah. I observed that she does this in at least two ways. She teaches through using students' background knowledge and through using real world applications.

Using background knowledge. To Sarah, a person’s background includes their cultural heritage and is a person’s “background, culture, heritage, family, where they come from, what their beliefs are…and I share a lot of that background with my students.” When thinking about the background of her students, Sarah considers their families, their socioeconomic status, the obstacles that they might have ahead of them, and the drive to succeed. She reiterates that they have to have that drive. No matter if they just came from Mexico or if they have been here since their pre-kindergarten years, “you have to have that drive.” She affirmed that she understands where her students are coming from. “I tell them, I’m the same as you. I came from the lower socioeconomic class. But you can make it. That helps out a lot too.”

Sarah said she shares her life with her students. She tells them about her dogs and about other events from her background. Doing this encourages her students to share their lives with her. She tries to use the information they share in teaching them. She tries to tie instruction into the traditions she sees in their homes and families. She reiterated that she gets to know them well by the stories they tell. She said that she can tell that the students want to better themselves. She said: “You see the hope, and you see that they want to come out of it…and you get to know them pretty good.”

Using real world application. During a lesson on multiplication, Sarah had her students create their own multiplication problems. I asked her why she had students create their own problems. She said it was because she wanted them to be exposed to real life situations.

> …That multiplication is not just black and white. You don't just have 49 x 37. You have them in problems…It's, well you have 49 feet of something. A problem is not just going to be some numbers and here it is. It's going to be stated in word form…I keep telling them it's not about numbers. It's about somebody's going to tell you something with something…whether it's going to be add, subtract, multiply, or divide. Whether it's money, you go to Walmart…and it's not going to be: Can you subtract 30 cents from a dollar. No, it's going to be this is how much it is, and this is how much you have left. It's always going to be in a story context.

She said it was "just basic life. It's not just numbers handed to you. It's going to be in word form."

Sarah tied a lesson on rounding decimals or money to real life when she said: "A lot of you can help your parents when you go grocery shopping doing this." She said that that was where she applies real life rounding, when she is grocery shopping. She said: "I was thinking, how could I help these kids make that connection to life? I just wanted to make that life connection for them." And she said, "they use it." They will come and tell her that they went grocery shopping with their mother and they helped her with the numbers. So she started using the Walmart flyer. This is her third year using it. She said it was fun for the students, and fun for her watching them doing it. Also, in a lesson of measurements, students chose examples from real life to illustrate their measurements. For example, for an example of a yard, a student chose a baseball bat or the width of a desk.

In a lesson on possible outcomes, Sarah used the real life example of going to Pizza Hut and ordering a pizza. I asked her why she used a pizza and she said that every once in a while the fourth grade teachers get together and order pizza for their classrooms. So it's something that they understand. It's something that they like; something that they are familiar with. She will also tie math to real life situations like the

kind of jobs that they may have in the future. For example, she tells her students, if you want to be a cashier you have to know how to subtract. She related that she had one student who said he wanted to be a drug dealer. She said: "well, OK, you still have to know how to do place value." He said: "well why?" She said: "Well, think about it. If you miss a zero, instead of a million, you would get a hundred thousand." And he's like: "well, J. doesn't have problems." And Sarah said: "I don't want to hear about it." "But," she said, "you have to tie it in because that's all they know."

Teaching through music, rhymes, movement, and visuals. Students learn through using different learning pathways such as music, rhymes, movement and visuals. Sarah used at least two of these pathways during the lessons I observed. The two pathways that I observed most often were visuals and rhymes. She used memory aids to assist her students in remembering new information.

Using memory aids. Sarah used rhymes and sayings and visual aids to assist her students' memory and provide a pathway for learning.

Using rhymes and sayings. Like the other teachers in this study, Sarah used rhymes and sayings to help her students remember information. A common saying when they were rounding numbers was: "five and up bump it up, four or less, let it rest." And when they were doing area and perimeter they would say a rhyme or sing it to the tune of *Merrily We Roll Along*. The rhyme for area was: "For area you multiply, multiply, multiply, for area you multiply always length by width." And for perimeter they would say: "For perimeter you add all sides, add all sides, add all sides, for area you add all sides that's what we must do."

Using visual aids. On two occasions that I observed Sarah had her students make visual aids. On one occasion the students made a booklet about measurements. The booklet consisted of 5 x 7 cards stapled together. The students wrote measurements in their booklets and drew examples of that measurement. Some students had the Standard U.S. measurements and some had metric measurements. The students drew examples from their environment for their measurements. For example, for an inch, many students

drew a jolly rancher in their booklet. A foot was a ruler or a textbook. Some students determined that a baseball bat was equal to a yard. Some students chose a grain of rice as an example of a millimeter. For a centimeter some students referenced a pencil eraser. Others chose the fingernail of the little finger. For a yard students referenced a pre-kindergarten student. For a meter, students referenced a kindergarten student. Sarah had both a kindergarten and a pre-kindergarten student come into the classroom so students could see the difference.

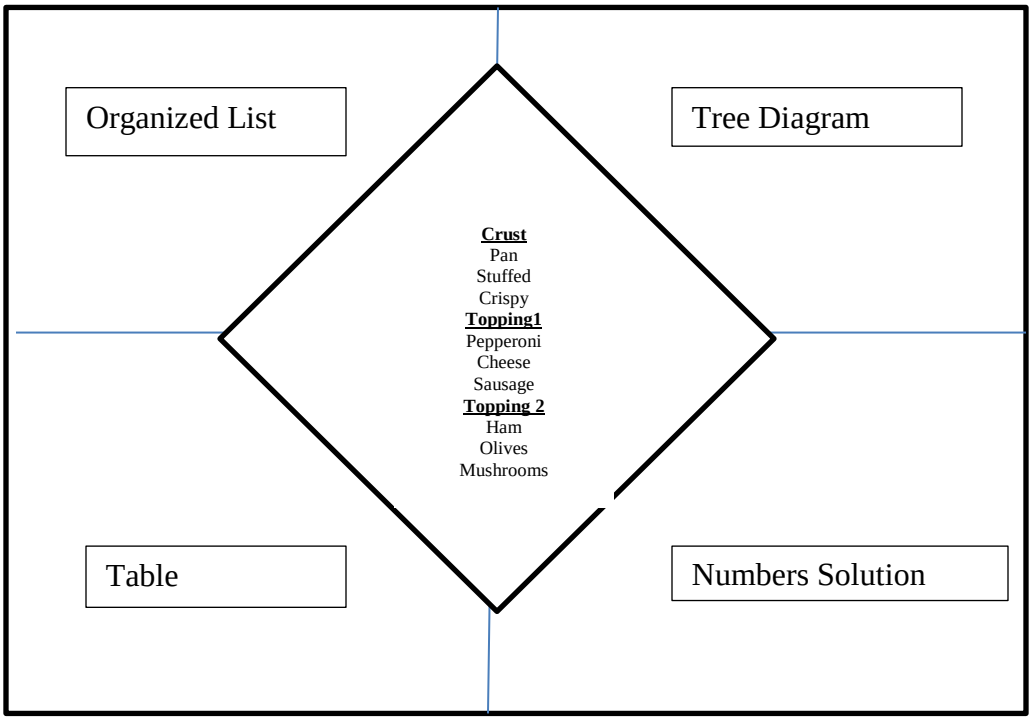


Figure 4: Possible Outcomes.

She said they were going to be working with making a pizza for their possible outcomes. One set of information was the type of crust, either pan, stuffed, or thin and crispy. The second set of information was the toppings pepperoni, cheese, and sausage. The third set of information was another set of toppings; mushrooms, ham, and olives.

Sarah passed out a blank sheet of paper to each group of two students. She had them fold the paper horizontally in half first. Then they folded the paper again in half

horizontally. They then folded down one corner of the paper. Inside were four sections sectioned off with creases. Sarah had the students outline the creases with a marker. Inside the diamond, Sarah wrote the three sets of information. One the curst, two a set of toppings, and three another set of toppings. She wrote organized list, tree diagram, table and number solution one in each of the four sections. Sarah took the students through the steps of making a tree diagram of the combinations. She told it like a story using student's names in the narrative. Mr. Perez (pseudonym) wanted pan crust pizza with cheese and mushrooms. She said the next one they were going to do was the organized list. She took them through the steps of creating an organized list. Then she said, "I'm going to do the table…real quick." Finally she did the number solution 3 x 3 x 3 = 27 combinations.

Collaborative groups. Sarah often had students work in collaborative groups. She had students sitting in pairs in the classroom and she often had them check each other's work. In one instance Sarah put the students in groups of two or three for a lesson on possible outcomes. She passed out a piece of chart paper to each group. The students folded their papers so that there was a diamond in the center and four divisions. Sarah said:

> We are going to deal with ice cream. The first set of information you have to deal with is do you want a cone or a cup? The second set of information is what flavor do you want, Vanilla, chocolate, or strawberry? The third set of information is the toppings, nuts or sprinkles.

The students wrote "ice cream" in the diamond and the three sets of information plus one for the number solution in each of the four divisions. Sarah told the class that if they needed help to go visit their neighbor. She walked around the class and helped where needed as they students were doing the exercise. They did not finish the project that day but Sarah said they would finish it the next day.

In another instance Sarah had the class create a graph by drawing out colored circles from a bag without looking in the bag and taping them to the smart board screen to form a graph. The colored circles the students put into the graph were five aqua, two

purple, six lime, six blue, and four rust. Sarah told the class they were going to work with a partner to generate questions for the graph then they were going to make a graph of their own. Some of the questions the students generated were: "How many more students chose lime than purple?" The answer was four. Another question was: "Which two colors equal the same as blue?" The answer was purple and rust. A third question was: "How many colors in all?" The answer was 23. Sarah then had the students make their own graphs. She told them they could use their favorite football teams or their favorite zoo animals or whatever they liked. When they had completed their graphs, Sarah had them create their own questions for their graphs. They did not finish their graphs and questions during the class period. Sarah said they would finish it the next day.

Motivation and engagement. Sarah tries to motivate and engage her students as part of her program for successful teaching in mathematics. In this section I review some of the means by which Sarah motivates and engages her students. They include the use of food and other reinforcements and playing games.

Use of food and other reinforcement. Although Sarah said she prefers to give her students free time at the end of the day for good grades and good behavior, there were times when she offered a candy or other food as a reward. While students were working in their *Motivation Math* workbooks towards the end of one period, Sarah called out the names of several students. She said: "If I called your name, bring chips and a drink tomorrow. I called the names of the students who were actually doing the work." And when students were rounding using the Walmart advertising flyer and spending their hypothetical $100.00, she said whoever gets to $75.00 first gets a Smartie. Then she lowered the threshold to $50.00. Then the pair who got to zero first received a Smartie.

In order to motivate students, Sarah related that you have to find out what makes them "tick." "What makes them be grateful, what makes them want to learn, what makes them determined. It has everything to do with teaching them." One way that Sarah motivates students is through earning free time. She says: "I reward my kids. I tell them

'you give me your grades (no one could get below 70%, and no one could have a discipline referral) and I'll give you an hour on Friday.' And they work hard for it."

Playing games. Sarah said that her secret is that she tries to make learning fun for the students. It's not just drill, drill, drill. One of the things she does to make it fun is to incorporate games into her lessons. She tries to make sure that everyone has a chance to win at these games. She does this by paring a successful student with a student who struggles and the successful student will bring up the student who struggles so that everyone has a chance to win. For example, during a lesson on area, she gave each student dyad a sheet of grid paper and a decahedral die. She said: "One of you starts. You are going to roll it twice." Sarah rolled the die twice and got a two and a three. She said: "I'm going to create a 2 x 3 area model." She drew a 2 x 3 rectangle on the smart board grid. She said: "2 x 3 = 6" and wrote 6 in the rectangle. "Then your neighbor rolls. Let's say she rolled and got a 4 x 6." Sarah drew a 4 x 6 rectangle on the smart board grid. Sarah: "What is 4 x 6?" Students: "24." Sarah wrote 24 inside the rectangle. Sarah said: "The object is to see who fills up the page faster with area models." Sarah reminded her students to be sure to work carefully so they could fit many rectangles on their paper. They were to fill up only half a page, a whole page she deemed to be too much. To one pair of students Sarah said: "roll." The student rolled and got an eight. She rolled again and got a five. Sarah said: "Do an area model of 8 x 5." Another pair of students rolled an 8 x 7. Sarah said: "Draw an area model of 8 x 7." The students were engaged in the activity. Sarah reminded the students to put the equation on the inside of the rectangle not the outside. She said: "all right guys, what you need to do is put them right next to each other so you can have as much room as is available. The one that has the most area covered gets a little prize" There were squeals of excitement at this announcement. Sarah put one student's grid paper on the document reader to show the class how they had left a large space in the middle of their paper. She said: "You've got to use your space wisely." She showed another student's paper where they had put their rectangles back to back and had a lot of rectangles on their paper. Sarah pointed out that these students were using

their space wisely. When the time was up, the students added all their areas together to see who got the most. The pair with the most got a candy prize.

After a lesson on *three digits* times *one digit* multiplication doing the vertical model and the area model Sarah divided the class into two groups, blues and reds. She had students put their heads down while she wrote two problems on the board, one in blue and one in red. All the blue students were to work the blue problem and all the red students were to work the red problem. The object of the game was to see who answered their problem correctly first. Students were to stand up and say, for example, "red area" or "blue vertical." The students who finished first were called to work their problems on the board. If the student made a mistake, Sarah asked the class to correct him or her. If a student got stuck working a problem on the board, Sarah called another student to come up and help him or her. Sarah called on some to do the area model and some the vertical model.

Planning, monitoring progress and checking for understanding. Sarah uses lesson plans and informal and formal assessments to plan for instruction and to assess learning. She uses CSCOPE math program and offered a critique of its usefulness.

Using lesson plans, math programs, and assessments.

For Sarah, lesson plans are a guide, the lesson plan doesn't control the lesson. She affirms that "realistically, lesson plans to me, I don't want to say they are a waste of time…but you don't follow them like they were written in stone." She offers the example of one time she had to deviate from her lesson plans. She said her class understood fractions, and equivalent fractions, but when it came to ordering fractions they just couldn't understand it. "No matter which way you cut it they just couldn't understand it…and I was teaching them how to find the common denominator and go from there." But, she related, they were lost. "So I said, you know, let's just put this aside, let's move on to something else and then we will come back to it." Usually," she said, "it's just one or two students, but this time it was the whole class." In the meantime, they did a lesson

on measurement. Later they went back to ordering fractions. She affirmed that every day is different; you have to adjust to the students.

Gonzalez Elementary uses CSCOPE as their math program. I asked Sarah if CSCOPE includes lesson plans. She said: "No, we have to develop our own lesson plans. Though CSCOPE does tell us week by week what needs to be done." CSCOPE does offer a time line that she follows. But, Sarah asserted that:

> Some of it is ridiculous, because when you are doing numeration, addition and subtraction, they want you to introduce perimeter. And then two months later they want you to introduce area. I like to introduce area and perimeter together so you can see the difference. So you have to change it up.

Sarah also criticized CSCOPE by saying that it is "one little problem on a big piece of paper." She asserted that there is not enough practice for the concepts in CSCOPE and it is very incomplete. There is not enough material to introduce concepts and have the students practice with. She said that every once in a while there will be something in CSCOPE that she will use, but most of the time she makes up her activity sheets or she will find them on the internet. She and a co-worker will also share activity sheets that they have found. Sarah further criticized CSCOPE by saying that it is too "technical, too structured. It's like everything else, you have to manipulate it for your kids." By "too technical" Sarah meant that CSCOPE expects all the students to be at the same level. It also lacks scaffolding. "It's just boom, there it is, figure it out." Sarah related that she has to supplement CSCOPE quite a bit. She said they expect all the children to come with prerequisite knowledge already. And she feels that her students don't have the necessary prerequisite knowledge. She said, for example, that they have to teach the students how to add and subtract again and they are already into multiplication and division. "And then they only give you two problems…so it's very incomplete."

For their math textbooks, Gonzalez Elementary School uses *Envision* math textbooks. There are two consumable workbooks that come with the textbook. Sarah said she uses the textbook very little but she does use the workbooks frequently. They are

Motivation Math and *Interactive Homework*. She does not use them as homework, however, but as a supplement to what they are doing in class.

Sarah reported that she assesses her students in math every Friday. She says it's a good assessment of her too as she can see whether or not she needs to re-teach something. In addition to the Friday tests, she will do quick oral assessments from time to time. She is also able to assess students understanding when she has them come up and work on the board. If she can walk around while they are working and see that they are having very little problems, then she said she can be pretty sure that they understand the material.

Supports for struggling learners. Sarah shared that she has two students in her classroom this year who have learning disabilities (LD). They are inclusion students so all of their time is spent in general education. Occasionally on the days that I observed Sarah's classroom, a special education aide would come into the math class and work with the students with LD. Sarah said she works with them by studying them and finding out what makes them "tick." She claims that within three or four days of working with them she can begin to see their pattern and she can work better with them. She said she tries everything with them until she finds what "clicks" with them. She works on identifying the learning modality that is best for each student. It might be working with one student individually, it might be a peer tutor, it might be more visuals, or more hands on. She said that right now she has one of her two students with LD who likes to draw. She can understand better by drawing instead of just writing down the information. She draws stick figures with curly hair for the girls and spikey hair for the boys, but it is the drawing that works best for her.

Individual tutoring. One of the things Sarah does to help students who struggle is to keep them in from their physical education (P.E.) class and work with them individually. Or when the other students are working she will call up the students who struggle to sit with her at her desk and work with them individually. Much of what she does during individual tutoring is to work on their reading. "Because," she said,

"everything they do has a reading component." If she works with the students individually and they can't understand something with her she will use a peer tutor and if they still don't understand it she will place the student with another teacher. She said that she has a great team and that if one of her students does not understand the material with her she will send them to Mrs. Martinez (pseudonym) because she may have different teaching methods so the student can understand better. Another thing Sarah will do to help a student who is struggling is that during games she will pair the student who is struggling with one of her successful students so they have the opportunity to win. She related that "when they win at a game, their self-esteem goes up very high so for the next week they will be working very hard and bending over backwards so it works very well for that. It's a motivation."

MARY

Personal and Professional Background Information

Mary (pseudonym) teaches fourth grade at Gonzalez Elementary School (pseudonym). She was born and raised in a city close to the Mexican border in the Rio Grande Valley of South Texas and has lived there all her life. She stated that she grew up in a "low income" family. Mary identified herself as a Hispanic woman and is bi-lingual in speaking, reading and writing Spanish and English although she said she is more fluent in English. Mary was the first one in her family to go to college and graduated from a local university with a major in elementary education.

Mary shared that she was fortunate to have had wonderful teachers. She remembered her fourth grade teacher in particular as having made a big impact on her. Ever since fourth grade she has wanted to pursue teaching. She can remember thinking: "I'm going to be a teacher someday." Mary has been teaching fourth grade at Gonzalez Elementary School for 12 years.

Perceived effectiveness of pre-service and in-service training. Mary acknowledged that her pre-service training offered little in the way of preparation to work

with different groups of students such as those with gifts and talents (GT), those with learning disabilities (LD) or those who are English language learners (ELL's). She reiterated that the education curriculum was focused on teaching the "perfect classroom," there wasn't very much learning to work with "this kind or that kind of student." She added "you are pretty much on your own with working with different groups of students and you learn as you go." In-service training has also offered little in support of teaching special groups of students. However, there has been some support with students who are ELL's. Mary feels that teachers have to rely on themselves when it comes to teaching students with different learning characteristics or needs

Views on Teaching.

I asked Mary about her views on teaching. I specifically wanted to know her philosophy of teaching, what she likes best and least about teaching, some of the positive and negative interactions she has had with students, and some of the challenges she faces.

***Philosophy of teaching*.** Mary stated that her philosophy of teaching is that every child can learn, but every child learns differently. Therefore it is her job to "find that path to each child and get there as best as I can." To Mary, excellence in teaching means not giving up.

> An excellent teacher is someone who is willing to not give up no matter how hard or how frustrating or how tired or how many times the child needs the help…that they keep trying. Because there are times when I feel like "oh my goodness, you still don't get it?" But I have to remind myself you know, they don't get it yet. They are going to, I just need to keep at it and they will…because they have to. And I think that's what makes a great teacher; the willingness to keep trying.

***What Mary likes best and least about teaching*.** Mary said that the best thing about teaching is that every day is different. "It may have been a horrible day yesterday, but today is a new day and the student's attitudes may be different, my attitude may be different and the day is going to be better." Mary likes getting to know each student personally because they each bring something new into her life. She said that they are "fun, funny, and interesting" and she is curious to know what their future holds.

Mary stated that what she likes least about teaching is the amount of paper work that the district requires, much of which she believes in unnecessary. She said she will turn in a grade report on a child and "it will say that this child needs this, and this, and this." But, she feels that she knows where they are and what they are capable of, but it doesn't fit well on a written report.

> It feels like to me that they want all these papers from us, and especially now at the end of the year…with all these tests and things like that. And I don't know that they even look at them… or if it's just busy work for the teacher. And we have a lot of work as it is.

She said she also dislikes the politics entailed in the system. She related that it's who you know and what they can do for you. She feels that she is not very good at the politics.

According to Mary, excellence in teaching involves the ability and drive to do something well even when it is a lot of work for you. Also included in excellence are the characteristics of patience and persistence and willingness to admit that you don't know everything. She said that at times she lets the students see her struggle with something and she will sometimes tell them "I don't know how to do this. Look at how much work I had to do. I had to read it several times." It also includes "accepting when you are wrong sometimes and being willing to continue to learn from your students." Mary shares that she is a fairly patient person and this has contributed to her success as a teacher. She tries to understand "where they are coming from so that I can help them better."

***Positive and negative interactions*.** Mary noted that positive interactions in the classroom occurred when she worked with students and they finally understood what she had been trying to teach them whether it was academic or personal. Mary confirmed that it is gratifying to see them learn from their mistakes. It is a particularly positive event when she sees them start to take responsibility for themselves. She shared that she does have a few students who have difficulty taking responsibility for their actions. However, when they do she says: "good; you're on the right track."

Difficult interactions with students have occurred when students "shut down and refuse to do the work." Mary usually handles this by walking away from the student for a

time and giving him or her some time to collect him or herself. But, she said, "I don't go too far because the student needs to understand that they have two options: Get over it and do it because you have to or repeat fourth grade." Mary shared that sometimes she does get upset but she doesn't let the students see that because then "they feed on that." So she will just walk away and give them some time, then she will come back and address the situation.

Challenges. Mary disclosed that the greatest challenge in teaching is that parents don't seem to value education. She shared her view that there is not as much respect for education or for the teacher as there used to be. She explained that the parents seem to be more concerned that the student's feelings are not hurt than they are about learning. The parents seem to have the attitude of "let's help the student feel good rather than helping him grow and learn." Mary tries to teach her students that it is acceptable to fail because they are going to get up and try again and they are going to learn it eventually. "But" she reiterated "now days it's harder because the parents don't want their child to fail at all." She asserted that the parents seem to see the teacher more as a babysitter rather than a professional. They want the teacher to take care of any problems in the classroom. She stated that both parents and students are different than they used to be.

Mary views herself role as a role model for her students. She conveyed that she feels that she must demonstrate the behavior/actions that she expects from them, e.g. saying "thank you" when someone holds the door open for her. She makes it clear that "thank you and no thank you" should be common everyday language. She tries to make sure her students see her doing that because she expects that from them.

Views Concerning Students and Parents

Mary is concerned about the seeming lack of structure in schools and therefore tries to convey to other teachers that they need to have structure, consistency and high expectations for all students. Mary feels this is especially needed because what the students tell her about their home life suggests to her that most of them don't have structure and consistency at home. It is important to her that students realize that they can

trust her to follow through with her word for either a reward or a consequence. Students need to know what the boundaries are so they can say: “OK, now I know.” Mary stated that she believes this is one of the main reasons she is a successful teacher.

One characteristic of a successful student that Mary mentioned is that they understand and use technology. Most students have cell phones and computers at home. Often when Mary introduces a concept to her students, they want to know which web sites they can access to practice the skill and they will ask if they need a password. Frequently these web sites will have games that students can play. When they play the games they are practicing the skill but they don’t see it that way. “They see it just as playing games or doing what they did in the classroom.”

The most important characteristic of a good student Mary noted is willingness to learn. The good student knows that he or she is going to make mistakes and he or she is going to fall; that he or she isn’t going to be 100% all of the time. But the willingness to keep trying is crucial. Mary encourages her students: “Don’t give up and don’t settle for less than what you are capable of.”

Mary described the student who will do particularly well as being curious. She has one student in particular who notices things right away. He understands new concepts quickly, is very observant, and will try to implement what he learned at school at home. For example, when they were learning about soil in science, he went home and dug a hole in his backyard to study the soil. His parents are very involved in helping him explore whatever he wants to explore.

Mary described a student who is not doing well as being shy and hesitant to ask for help on anything she is having difficulty with. Mary is trying to encourage her to ask questions. Mary said she is slowly “coming out of her shell” and beginning to ask questions and ask for help. Mary said: “That’s a biggie for her, to ask for help. That was a struggle for her.”

What students need most to be successful. Mary believes that students need to know how to interact with one another in order to be successful. “They need to be able to

cooperate and compromise when the time comes. They also need to be able to stand on their own. It works both ways. But working together and teamwork is important." The three most important things Mary stated that she can teach her students about life are to love reading, to be curious, and to question authority but to question it respectfully. Mary said she doesn't mind if students catch her mistakes if they can tell her about it respectfully.

In addition, Mary said students need to learn to keep trying; that there is nothing wrong with hard work. She conveyed that this group of students doesn't like to work hard. Mary reminds her students that in the beginning of the year they were terrified of the multiplication and division problems and they couldn't do it. But now they say: "multiplication and division no big deal." Now when students are doing fractions Mary reminds them of when they couldn't do the multiplication and division and with a little work now it is not difficult. "It just takes hard work, but you can get there."

***Working with parents*.** Mary stated that there hasn't been very many parent initiated contacts this year. There have been a few parents who have contacted her, but she is hoping for more as the year goes on. Mary said she is usually the one to initiate parental contact by making phone calls about student needs. There are some parents who will text her and share that their child had a good day or a good week and that helps keep the lines of communication open in case there are any concerns that parents may have. But, Mary reiterated, there haven't been many parent contacts.

The information received from students has caused Mary to be concerned that students have little consistency at home and therefore they have difficulty at school. Students lack the knowledge that if certain things happen there will be consequences. Mary conveyed that contact with parents and comments from students suggest that the home life of some of her students is also very unstable. She tries to keep this in mind when working with them but without lowering expectations for them. Mary tries to help make up for the lack of consistency at home by being very consistent at school. She makes sure that students understand that the rules apply to everyone and that everyone

receives the same consequences for inappropriate behavior. Mary said that the students like to know what the boundaries are so she tries to set boundaries. Students need to learn that school is a public place and that there are different ways of behaving in public places. There are different rules of behavior and what's allowed or not allowed. "Students need to learn to follow the rules at school because they are different than at home."

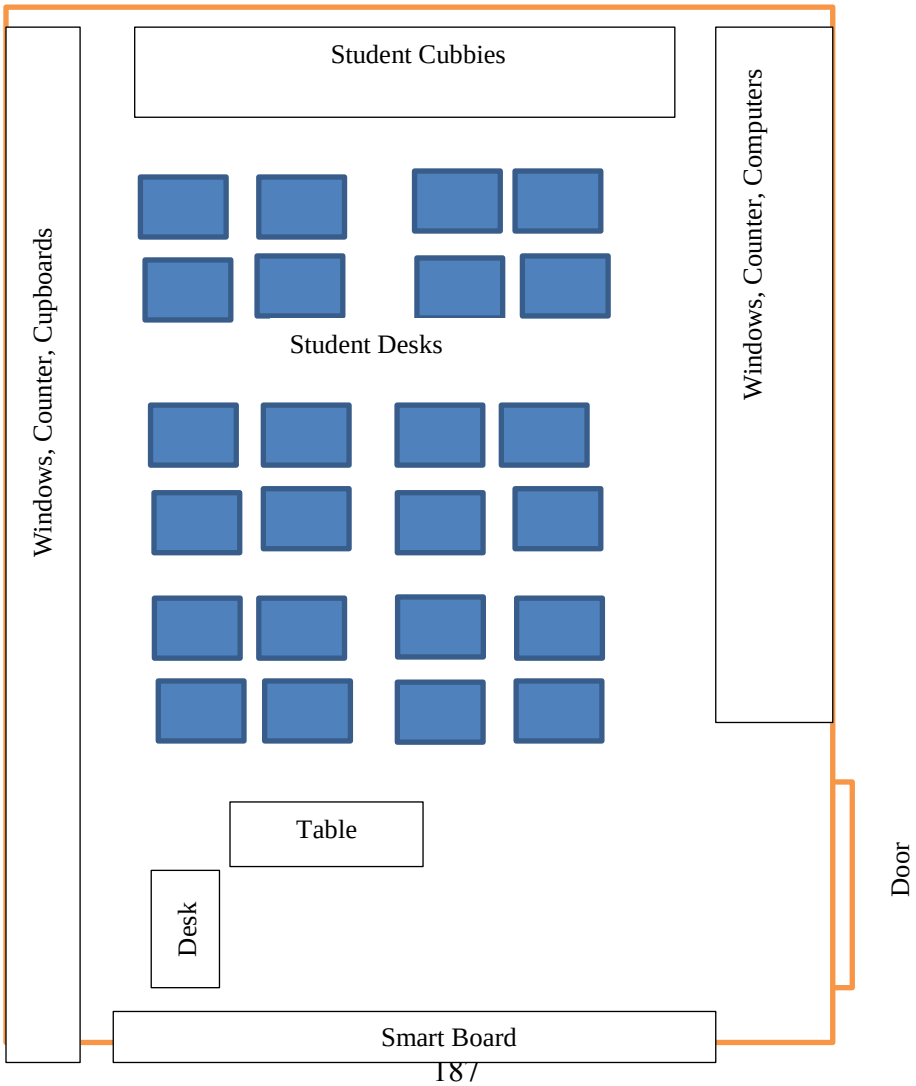


Figure 5: Mary's Classroom

A Typical Mathematics Lesson in Mary's Classroom

In the following section I describe the features of instruction Mary utilized in her math classroom. I begin with the classroom context of an average day in Mary's math classroom. I then go on to discuss the aspects of her math instruction that she used on a regular basis. Mary used a wide variety of strategies to teach math to her students.

Mary's classroom.

As I entered Mary's classroom students were transitioning from English Language Arts to math. They were putting away their reading books and taking out their math spiral notebooks. Mary was organizing her supplies for the math lesson. Standing near the door, to my right is a counter top that holds four computers (see Figure 5). Above the countertop are three wide windows that look out into the hallway. Across the back wall is a brace of cubbies that hold students back packs, coats, sweaters, papers, and books. To my left is the front of the classroom. There is a smart board screen covering a white board. On either end of the smart board screen are two bulletin boards. The bulletin board nearest to me holds student work and classroom rules. The other bulletin board is above Mary's desk and holds calendars and notices. In the corner sits Mary's desk. Her desk holds her computer and papers. Beside her desk is a table with one student sitting at it. In front of me is a wall that has several tall windows looking outside. Below the windows is a counter top that holds boxes and books. Below the counter are cupboards.

The student's desks are arranged in groups of four and take up the center of the classroom. I observed Mary on eight separate occasions. The following observation was chosen because it is representative of what I observed across all lessons. Mary began the day's lesson by putting up three problems on the smart board for students to solve independently. Two problems involved *two digits by two digits* multiplication and the third was a *one digit divisor by six digit dividend* problem. After a few minutes, Mary

worked the problems on the smart board so that students could check their work. Next Mary had students take out their *Motivation Math* workbooks. The assigned problems had to do with reading bar graphs. She asked: "When the question asks for a total what are your two options?" The students replied: "multiplication or addition." Mary reminded the students that when they were working to take one step at a time. She said: "Do not feel overwhelmed and do not panic." Mary worked the first two problems with the class using the document reader to project her work on the screen. The students worked on the next three problems on their own. The first question Mary worked concerned a bar graph. The question was: "How many more boys in a Cub Scouts pack at Cain Elementary would have to join pack D to equal the number in pack B?"

1. Pack A had 12 boys
2. Pack B had 15 boys
3. Pack C had 18 boys
4. Pack D had 12 boys.

Mary circled the word *more* and underlined the word *boys*. A student responded: the answer is three boys. Mary asked him how they got his answer. He replied that he had subtracted 12 from 15. The second question was: "What is the total number of boys in cub scouts at Cain elementary?" The students responded chorally: addition or multiplication. Mary affirmed: "Yes, your number needs to get larger." The answer was 57. Mary encouraged her students not to feel overwhelmed but to take it one step at a time. The students worked the next three problems independently. Mary told the students that if they had a question they could ask their face partner or their shoulder partner. She walked around the classroom as the students worked and responded to raised hands for help. After a few minutes Mary went over the problems with the group using the document reader. The next problem had to do with reading a bar graph. Mary used the document reader to model the solution. The students followed along in their workbooks.

Once they had completed the problems, the students were instructed to make a bar graph of their own. They were to work in groups of three to four students and create their

own data. When they had completed the graph, they were to develop three questions that corresponded with their graph. Mary said their graph could be either horizontal or vertical. The students took a moment to form their groups. Mary told the students they could use their favorite animals, favorite football teams, or favorite basketball teams. She told the students that she liked the way some of them were taking their time and working very carefully. Mary mingled among the students to help where needed. She told them that if they got stuck they should look at the examples in their *Motivation Math* workbook. When a group did not appear to know how to make their graph, Mary had them go around the classroom and see how other groups were making theirs. She had the class first put their graphs on a piece of 8 ½ x 11 piece of paper before they put it on the chart paper. Mary held up one group's completed graph as an example of what it would look like when completed. She said: "Even though you can do it either way, I would recommend doing it the long way because you can fit more information in there." She said: "Look at your examples in *Motivation Math*. They always label their graphs." She told them that as long as they already had their information and knew what it was going to look like, they could start on their chart paper. She had the students write their questions on a separate piece of paper. She said: "I like the way some of you are planning before you are writing." She told one student that while his group was drawing the graph he could be composing questions he wanted to ask about their data. Mary said: "Some of you are taking your time and they are coming out very nicely and I appreciate that." Mary reminded the students to use question marks at the end of their questions. After several more minutes Mary said they were running out of time. She told the students to staple their questions to their chart even though they weren't through with it. She told them that she would give them some time the following day or maybe later on that day to finish it.

Features of Math Instruction Utilized by Mary

In this section I label the features and present the themes of Mary's teaching. The following patterns or themes were derived from all observations combined and they present the most frequently occurring features of Mary's math instruction. These features

include: reviewing previously learned concepts; teaching through music, rhymes, movement, and visuals, collaborative group work, motivation and engagement, and supports for struggling learners.

Reviewing previously learned concepts. Mary frequently began the day's lesson with a review of what they had learned the previous day. At times she would use an activity sheet to review previously learned concepts, other times she worked on the board or used the students' textbook. On one occasion, as a prelude to an activity sheet, she asked the students questions concerning division that they had learned the previous day. Mary reminded the students that with division they had one total and they were taking out an equal amount. Mary: "And the ones we had left over were called the what?" Students: "the remainder." Mary: "What did we call the inside?" Students: "the dividend." Mary: "yes, and then we have the divisor and the quotient."

Using activity sheets. Mary frequently used activity sheets to reinforce previously learned concepts or to practice recently learned concepts. On one occasion Mary distributed an activity sheet. She used the document reader to work the problems with the students. She worked one or two problems from each page. The first question was: "Martha placed her CD's in the following arrangement. Which number sentence best represents the arrangement of Martha's CD's?" Mary asked the students what they could get out of the word arrangement. They replied that they could get the word array. Using the document reader, Mary worked through each suggested answer while the students identified whether or not that was the answer to the problem. The next page of the activity sheet was word problems with multiplication. Mary asked the students to identify in the problem what they knew for a fact. Then they identified the question. Mary advised her students to identify information in the problem that they did not need. Mary randomly called on students to read the problems. The first problem was: "Cara bought nine cases of green beans and four cases of corn. Each case has 12 cans per case. How many cans of green beans did Cara buy?" Mary said: "Let's start with our known facts. We know that Cara bought nine cases of green beans and four cases of corn. We also

know there were 12 cans per case." Mary asked the students what the word "per" meant. The students replied that it means "each." Mary said if the word "each" is in the top part of a problem most of the time, not always, but most of the time it means multiplication. Mary asked the students: "what do we not need in this question." The students replied: "the corn." Mary said: "Let's multiply. What do we multiply?" Students: "12 x 9." Mary: "What is 12 x 9?" Students: "108." Mary: "Yes, our answer is 108." Mary did one more problem on the activity sheet having to do with multiplication. A student pointed out that the word "each" was in the top part of the problem before the question. Mary had the students work independently while she walked around the classroom and helped where needed.

On another occasion Mary distributed an activity sheet for the students to practice their multiplication and division skills. The first problem was $87 \div 5$. Mary put the problem on grid paper and used the document reader to project it onto the screen.

Mary: 5 times what number gives you 8 or close to 8 without going over?

Student: 1.

Mary: And 8 minus 5 is what?

Student: 3.

Mary: Bring down the 7. What number times five gives me 37 or close to 37 without going over?

Student: 7.

Mary: Right. The answer is 17 R 2.

Mary said that first they were going to review some problems together on an activity sheet and then they were going to work with a partner. Mary modeled solving the problems on the activity sheet using the document reader. The first problem was $67 \div 4$.

Mary: Ask yourselves what number times 4 will give you 6 or close to 6 without going over.

Students: 4 x 1.

Mary: What is 4 x 1?

Students: 4.

Mary: What would happen if I decided to put a 2 on top?

Students: It would be too big.

Mary: Right, it can't be bigger than the number in the dividend. What do you do underneath?

Students: You subtract 4 from 6 which would give you a 2.

Mary: What happens next?

Students: The 7 drops down.

Mary: What is the rule on dropping?

Students: You only drop one number at a time.

Mary: Right, no matter how many numbers you have in the dividend, they only drop one at a time. So then we go back to the divisor. What number will give me 27 or close to 27 without going over?

Students: 6

Mary: And what is 4 x 6?

Students: 24.

Mary: Subtract 24 from 27 and you have 3, so the answer is 16 r 3.

Mary next reminded the students to check their division through multiplication. The next problem they worked was $87 \div 5$. Mary went through the same steps with the students using the document reader.

Working on the board. At times Mary had students come up to the board and work problems. She usually did this when the rest of the class was working independently on an assigned task (e.g. an activity sheet). On one of the days I observed she had the students do 10 problems from their math textbook. She told them to raise their hands if they encountered problems. The problems involved rounding decimals to the nearest whole number. She set a timer for 15 minutes. Mary randomly called on students to come up to the board and work. She had popsicle sticks with students names

written on them. When she wanted to randomly choose a student, she pulled a popsicle stick out of the pack. Mary stopped calling on students to work on the board for a few minutes while she worked two of the rounding problems on the board. The first one was *31.95*. The first thing she said to do was underline the one.

Mary: Which number is going to be the "boss?"

Student: The 9.

Mary: What is the "boss" saying?

Student: "Bump it up one plus one.

Mary: So the number becomes 32.00.

The other problem was *2.59*. Mary called on a student to read the number. He read it as two and 59 hundredths. Mary underlined the two and circled the five.

Mary: Who is the "boss" here?"

Student: The 5.

Mary: What is the 5 telling the 2?

Student: To bump it up to 3.

The students resumed working in their math textbooks and Mary went back to calling on students to come to the board and work problems. Mary coached each student at the board while everyone else worked independently.

Mary began class on one occasion by reviewing multiplication for the fives on the board. She asked if there was a pattern for the fives. The students responded that the pattern in the fives was 5,0,5,0,5,0. Then they moved on to multiplying by sixes. She asked the class if they could find a pattern in the sixes. The students responded that the pattern is 6,2,8,4,0 then it repeats, 6,2,8,4,0. They also looked for a pattern in the sevens but didn't find one. Mary reviewed the multiplication and division fact family for the sixes: 6 x 2 = 12, 2 x 6 = 12, 12/2 = 6, 12/6 = 2. She said "if you know one you know the others." She said to her students "sometimes you get stuck when you are working on the computer and you have a problem like '42 divided by what number equals what?'" She pointed out that it's part of a fact family. "If you're better at multiplication than with

division you can switch it up. You can do six times what number equals 42." She repeated the process with 7 x 8. She showed her students that multiplication and division are related: 56/? = 8, 8 x ? = 56.

Modeling on the board in a lesson on reviewing rounding, Mary wrote down the numbers from one to nine. She asked the students where to draw the vertical line. The students responded between the four and the five. Mary said: "very good. Four or less let it rest, five and up bump it up plus one." The first number that students were to round was 7,634,109. Mary told students to round it to the nearest hundred thousand's place. Mary modeled the solution by underlining the six and circling the three. She said the number three was the "boss." Mary asked the students what the "boss" was saying. The students replied that it was saying to let it rest. Mary: "so the six stays the same and the numbers to the right become what?" Students: "zeros." Mary: "What happens to the seven?" Students: "It stays the same." The next number was 943,978,610. The students were to round it to the nearest millions place.

Mary:	What number is in the millions place?
Student:	The three.
Mary:	Go ahead and underline it. So if we underline the three which number will be the boss?
Student:	The nine.
Mary:	Go ahead and circle the nine. What is the nine telling the three to do?
Student:	Bump it up plus one.
Mary:	So the three becomes a four and the numbers to the right become?
Student:	Zeros.
Mary:	So the new number is 944,000,000.

Mary went through the same process with the number 49,873,201. The students were to round to the nearest millions place. The students determined that the rounded number was 50,000,000.

Working out of the textbook. On another occasion Mary began class by reviewing previously learned concepts through working from their textbooks. She had one student from each group pass out the textbooks to the members of his or her group. She said: "We're going to do a quick review of what we were doing yesterday multiplying by 10's and 100's." Mary directed the students to turn to a certain page of their textbooks. She said: "We are just going to say the answers for numbers one through six." The first problem was *7 x 10*.

Mary: What do we do?

Student: 1 x 7 = 7.

Mary: Then what do we do?

Student: Add one zero.

Mary: Why only one zero? We are doing multiples of 10. How many zeros does 10 have?

Student: One.

Mary: The next one is 2 x 100. What is the answer?

Student: 2 x 1 = 2. Then add two zeros so the answer is 200.

Mary: Work step by step so you won't forget. What is 2 x 30?

Student: 60.

Mary: What is 9 x 800?

Student: 7,200.

Mary: Very good.

Mary next assigned additional questions in the textbook. She randomly assigned problems to be solved by individual students. Some problems were: *4 x 20* and *7 x 20*. Students called out their answers as they were called on by the teacher. Mary responded to student answers by saying "correct" or "excellent" and no one gave an incorrect answer. Mary reminded the students to look carefully at their numbers by saying: "The biggest problem that I see with these is adding too many or not enough zeros. So look at

your numbers. Take a second count." Mary then said that they were going to do a page in the textbook as a review of what they did the previous day.

Teaching through music, rhymes, movement, and visuals. Mary taught through using different pathways for learning. I observed that she used at least two different pathways while teaching. They were visual and music and rhymes. She did this through using memory aids and solving problems on the board.

Using memory aids. Mary used two main memory aids while teaching. They were using rhymes and sayings and visual aids.

Rhymes and sayings. Similar to the other teachers in this study, Mary used a familiar rhyme to teach area and perimeter to the students. On one occasion when they were studying perimeter, Mary led the class in singing: "for perimeter you add all sides, add all sides, add all sides, for perimeter you add all sides that's what we must do." On another occasion when they were studying area Mary led the students in singing "for area you multiply, multiply, multiply, for area you multiply, always length times width." These songs were sung to the tune of *Merrily We Roll Along.* Another saying they used as a memory aid when rounding numbers was: "four or less let it rest, five and up bump it up plus one."

Visual aids. For a lesson on possible outcomes Mary had a student pass out a blank sheet of paper to every student. They folded the paper in half then in half again. Then they folded down the closed corner so that when it opened up a diamond shape was in the center and there were four sections to the paper (see Figure 6).

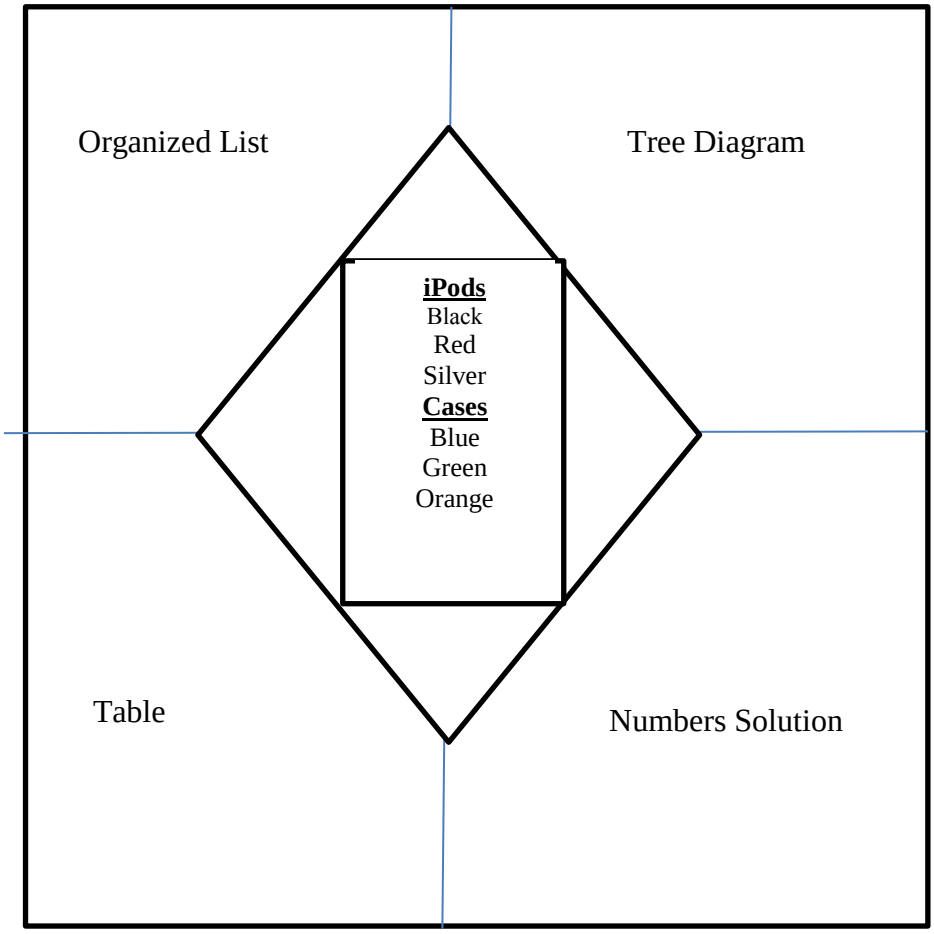


Figure 6: Possible Outcomes

The students then drew lines where the creases were with markers. Mary wrote "possible outcomes" inside the diamond in the center. She used the document reader to project the image on the screen in the front of the room. She said: "Yesterday we did the tree diagram." She wrote "tree diagram" in one of the four sections of the paper. "We also worked on number solutions." Mary wrote "numbers solution" in another one of the four

sections of the paper. Mary told her students that they were going to work on the organized list and the table. She wrote "organized list" and "table" in the remaining two sections of the paper. She wrote "iPods" inside the diamond on the paper. Mary wrote down three colors for iPods and cases respectively. Mary asked: "Who remembers how to do the numbers solution? The quickest way is to use the numbers solution." A student volunteered "3 x 3." Mary: "How did you figure out to use 3 x 3?" Student: "three I pods and three cases." Mary wrote 3 x 3 = 9 in one section of the paper. Mary asked: "What does the nine represent?" Student: "combinations." Mary: "Yes, we can choose nine different combinations of "iPods" and "cases." Mary drew a tree diagram using the different combinations of "iPods" and "cases." She also showed them the outcomes if you added with or without headphones to the list. You would have 3 x 3 x 2 or 18 possible outcomes. Next Mary said "Let's work on an organized list." Mary wrote an organized list of the possible outcomes for the "iPods" and "cases" in the appropriate section of the paper. She next drew a table of possible solutions in the remaining section of the paper.

Solving problems on the board. Mary utilized the smartboard or the document reader in two ways. She frequently had students come up to the board to solve problems individually. She also used the board as a tool to model problem solving for the students.

Individually. Mary gave her class a multiplication activity sheet to work on while she called upon individual students to work problems on the board. She said: "If you don't get this, don't worry you will get it. I will work with you individually until you get it." The activity sheet had problems that were *two or three digits by one digit* multiplication. The first one was *6 x 37*. Mary told her students: "I don't want you to solve it horizontally I want you to do it vertically with the smaller number on the bottom and the bigger number on the top."

Mary put some multiplication problems on the board for students to solve. The first problem was *64 x 7*. Mary said: "Violet [pseudonym] walk me through this." Violet explained each step as she worked a problem on the board. The next problem was *83 x 9*.

Another student explained each step as he worked the problem on the board. Mary asked her students how many felt really good about doing these. Most students indicated a positive response by putting their thumbs up, but Mary said they would keep practicing. Mary continued to write problems on the graph paper under the document reader and called upon three or four individual students to "walk me through this."

Teacher modeling. Mary modeled solving problems on the board going one step at a time. She encouraged her students to also work one step at a time. She often used a sheet of graph paper under the document reader to work the problems. On one occasion the students reviewed *two digit by two digit* multiplication problems by generating some *two digit by two digit* multiplication problems to work. The students took turns giving the teacher their problems and she modeled how to solve them on the board. After a few minutes of this, Mary wrote on the board three multiplication and three division problems for students to work. She asked the students to work the problems individually on the board. After students were finished with the problems, Mary had them turn to a page in their *Motivation Math* workbooks. She modeled how to solve the problems using the document reader. The lesson was on identifying the missing operation and number. The problems had to do with working with an "in and out machine." In an "in and out machine" a number goes into the machine and another number comes out. It is the student's job to figure out what operation was performed on the "in" number to equal the "out" number. Mary addressed the students: "If a number starts out bigger and gets smaller you have two options. What are those two options?" Students: "subtraction or division." Mary: "If the number starts out small and gets bigger what are your two options?" Students: "addition or multiplication." In the first problem the "in" numbers were 45, 37, and 29. The "out" numbers were 90, 82, and 74. The answer was to add 45 to each number. Mary reminded her students to be thorough by saying: "You can't just work the first one and assume that is the answer. It has to be true for all three. You have to make sure the pattern is true all the way through."

Using collaborative groups. Mary said that the reason they do collaborative group work is so that the students can learn to work together and learn from each other. Mary used some form of collaborative group work every day that I observed. At times the entire class period was taken up using group work, at other times it was used to check work or to do a single problem together. In the following instance collaborative group work took up most of the period. The students were instructed to use one sheet of poster paper as a group and make up a multiplication problem for other groups to solve. They were already seated in groups of four. The problem had to be written out in sentences, it could not be only numbers. They were to write out their problem first on an 8 ½ x 11 sheet of paper then transfer it to the poster sheet. Mary told the students that they could include numbers that were not needed. Some of the students became confused between writing a multiplication and a division problem. Their first attempt was: "There were 15 dogs in the shelter divided evenly between five cages. How many dogs were there per cage?" Mary pointed out to them that they had written a division problem. The students changed their problem to: "An animal shelter feeds it's dogs three times per day. They have 98 dogs. How many total feedings do they give in a day?" Another group's problem was: "There are four bookshelves in a bookcase. Each shelf has 12 books on it. How many books are there in all?" Mary walked around the classroom and helped where needed. Many students needed help wording their problems. Mary said: "Some of you are working very well and others are taking a while." She led the thinking of one group by saying: "You are missing something, what are you missing?" She said to one student: "You need to talk with your partner. He knows the multiplication better than you know the multiplication." The students brought up their problems for Mary to check before they put them on their poster paper. As students finished their posters, Mary had them work on their multiplication facts. Mary said: "I'm going to call on one group at a time to come up and pick up a problem to be solved in your group." In their groups, students solved the problems written by other groups. When students were finished they handed the papers

back to the original group and checked their work. Mary read some of the problems to the class but they did not work any of them out.

On another occasion students were given a activity sheet and Mary worked the first two problems of the activity sheet using the document reader. She then had the students answer the third question with their shoulder partner. Mary said: "I want to see the work. I don't just want the answer. I want to see the work that got you the answer." Mary walked around the classroom and helped where needed. In another instance where the class was working on a activity sheet, Mary told the students that if they had any question they were to ask their face or their shoulder partner before they asked her.

During a lesson concerning "in and out machines," Mary told the class that they were going to work in groups to make their own "in and out machines." She assigned students to groups and gave them a few minutes to find each other. She gave each group eight Post It notes. Mary told her students to figure out their rule first. For example, a group could choose the rule to add 15 to each number. If a student chose 30 as their "in" number, then 45 would be their "out" number. Mary told her students to write the numbers on the post it notes. Mary then gave them an example of what the Post It notes would look like once they were filled out. Mary divided a sheet of poster paper into eight segments. The Post It notes went up on the segments. Eight Post It notes per segment. Two Post It notes per person in the group. Mary called one group at a time to come up and post their notes. Mary then led the class in figuring out what some of the rules were for the "in and out machines."

Motivation and engagement. Mary's students were motivated and engaged during all of my observations. She accomplished this by keeping a brisk pace to her lessons and by allowing little time when students were not engaged with the lesson. She said "I have to keep moving very quickly because If I don't they can get really out of hand. So I try to move very quickly." She also motivated them through verbal prompts and encouragement. For example, when they were working on a activity sheet that the students found challenging, Mary encouraged her students by saying: "If you don't get

this, don't worry you will get it. I will work with you individually until you get it." And: "If you don't get the first one, it's ok, you will eventually. You're going to get it." And again: "If you don't get this, don't panic. You will get it." Although I never saw Mary give her students candy or food as a reward, she promised them a candy treat on one occasion if they worked the math problems correctly. "Most of you are getting these correct. If you get them done correctly and show your work, you might get a treat."

Using the textbook and monitoring progress. On several occasions that I observed Mary had students work out of their *Envision* math textbook. On one particular occasion she had students do 10 problems from the textbook. She told them if they got stuck to raise their hand and she would come and help them. The assignment had to do with rounding to the nearest whole number. Mary had individual students come up to the board to work on a rounding problem while the rest of the class worked at their desks. Mary reminded her students to show their work, they could not just put the answer. She told them she wanted to see where they made a mistake if they made a mistake.

Mary explained the textbook's strength is that it builds a good foundation, it's weakness is that it only has 10-15 problems that the students can practice on their own. The other problems are too difficult for them. Mary said she doesn't use the textbook too much but she sometimes uses it to start a lesson. She uses the *Interactive Homework* workbook and the *Motivation Math* workbook which are part of *Envision* fairly often. She doesn't use them as homework but uses them in class so she can be there to answer student's questions. But again, they only have 10-15 questions per lesson. So Mary searches on the internet for activity sheets to do with her students. She says that if she finds a activity sheet online she will print it out and make enough for the other fourth grade teachers. For example, she said she found a website where she could make her own bar graphs.

CSCOPE is the math program that the school district has adopted. Mary said the strength of CSCOPE is that the timeline follows the student's progression of learning. All the fourth grade teachers follow the timeline. It's weakness for her is that it is more for

teachers who have little experience teaching math. It gives a very detailed script of what to teach. Mary said one lesson could be 20-30 pages long. She said that most of the activity sheets that come with CSCOPE aren't helpful either.

Mary stated that she rarely makes lesson plans. She follows the timeline in CSCOPE that tells them where they need to be, but she likes to "go with the kids; let the students guide me." She says she doesn't let lesson plans control her day because every day is different and every class is different and every year is different so she goes based on what the students need not on what the lesson plan says. She said she doesn't mind if it takes longer or goes faster than it would have the previous year because it is important to her that the students understand the lesson.

Mary usually assesses her students in math weekly. She obtains her assessments mostly from on line sources. Some assessments they acquire from old tests and some they acquire from *Motivation Math*. All the fourth grade teachers generally use the same tests for assessment. They will find something they like on line then make copies for all the other fourth grade teachers to use.

Supports for struggling learners.

Mary related that most of her students were at grade level in math when they began school during the fall. She said that maybe one third of them were below grade level and she has three or four who really struggle with math. "But," she notes, "that's not too bad." She did not have any students receiving special education during the year in which my study was conducted. But sometimes she will help the other teachers with their students receiving special education. She shares that one of the problems she has with the learners who struggle is that they hate math. "So it was me trying to get them over that like…you don't like it doesn't mean you can't do it. You need to; you're going to learn." Mary's expectations for students who struggle are no different from what she expects of everyone else. She noted that they may not be able to reach 100 percent accuracy, but they can improve from 20% or 30% to 80%. "They need to show some improvement. And they know that they need to show some improvement."

Working individually. Mary deals with students who are below grade level in math by working with them individually. She has a place reserved at a table in the front of the room next to her desk for students who struggle to sit. For instance during all my observations she had one girl sitting up there. She said that "this student is a big struggler in just about everything." Mary shared that this student likes to talk frequently when she is sitting at her regular desk and she doesn't pay attention. So Mary has her sit at the front table so she can keep an eye on her to make sure she is paying attention and doing the work. If there is another student struggling, Mary tells her to move over so the new student can sit by her too. Mary shares that she moves very quickly because that's the group of students that she has. But she says she tries to keep in mind that there are some students who need extra time.

> So even though I am moving quickly, I say in the back of my head, I need to sit with them and maybe try a different method. For instance draw pictures which might help them see the problem better. Or actually use manipulatives that will help them see what the problem is. Sometimes that helps…and just keeping at it. Not letting them just sit… because they will get it eventually. Maybe not the first, second, or third time they try. Maybe they need 10 times before they get it but they will get it.

Mary also has students who are struggling come in during the time breakfast is served in the morning. She has them sit with her at her desk so she can help them. She will have one or two at a time work with her. Also after the lesson in math, when other students are working independently, she makes sure that she stays around the area and keeps after the students who are struggling. She asks them: "How did you get that number? What's going on? To make sure they understand it. Because if they can explain it to me, then they are going to be OK."

Mary also at times gives students who struggle extra work to do. For example, she said she sat with a student who was having trouble with the rounding and she gave him extra work after lunch. She said she tries to be positive with her students and to encourage them that they will be able to do it with a little more practice. If Mary has a larger group that is struggling she will keep them a few at a time in from their physical

education (P.E.) class though she says she doesn't do that too often. When I asked her how often she works with students individually, she replied that she thinks she does that every day. Based on my observations, Mary has some portion of the class period each day set aside to work with students who struggle.

MIGUEL

Personal and Professional Background Information

Miguel (pseudonym) is a Mexican-American man who teaches all sections of fifth grade math at Gonzalez Elementary School (pseudonym). Miguel was born in Mexico and moved with his family to the United States when he was seven years old. He spoke only Spanish when he arrived and reports that he was spanked at school for speaking Spanish there. He has lived in the Rio Grande Valley of South Texas for about 40 years. Miguel identifies as a Mexican American and speaks, reads, and writes Spanish and English. He shared that his family was extremely poor when he was a child. His father did field work for the first few years in the U.S. then became a maintenance worker for local state parks. As a student he took part in University Interscholastic League (UIL) math competitions and currently volunteers as a UIL coach at his elementary school.

Originally Miguel did not want to become a teacher because he didn't want to develop lesson plans. He joined the military and was in the U.S. Air Force for eight years as a medic and a recruiter. When he left the military, he attended a local college and obtained a bachelor's degree in psychology. He continued his education with two masters degrees, one in counseling and one in education. He became interested in entering the school system but learned that counselors don't have the time to do very much counseling. At that time he felt that the classroom would probably be a better place for him. He reported that he has found that he can act as a counselor to his students. Miguel has been teaching for 12 years. Three years with another district, and 9 years with his current district. He has been teaching at Gonzalez Elementary School for one year. Miguel has taught both third grade and fifth grade in the past.

Perceived effectiveness of pre-service and in-service training. Miguel is certified to teach students with gifts and talents (GT). However, he feels that his UIL experience has better prepared him to work with high performing students than the GT training. He believes the UIL training that he provides students prepares them better for the state achievement test than any other classroom training he could give them. Miguel reported that his pre-service training did little to prepare him to work with different groups of students such as those students with learning disabilities (LD), those from lower socio-economic status (SES) backgrounds, and those who are English language learners (ELL's). However, Miguel reported that the district offers in-service training every year on students with LD. But there has been very little training on working with students from lower SES backgrounds or students who are ELLs.

Miguel shared that students who are ELLs struggle with their reading skills in English. He stated that some of them speak and read English well but they don't necessarily understand what they read. This causes problems in teaching them math because the students "don't want to do the reading required in math word problems." Miguel reported that many of the ELL students like the computation problems but they don't want to do the reading problems.

Miguel stated that there are large numbers of students from families who are "economically disadvantaged." He feels that these students don't have middle class values. The value most noticeably absent to Miguel is the work ethic. He asserted that students are interested in immediate gratification and that it is difficult to get them to do their homework appropriately rather than just putting down any answer. Students lack the effort to improve. He reiterates that many of the students don't like reading. "The typical Hispanic low economic [sic] doesn't like reading. That presents itself as a problem not just in the reading area but in math which is really a reading test with math on it." Miguel asserted that many of his economically disadvantaged students don't like math, especially in the beginning. But some of them begin to like it around the time the pressure is off

after the state achievement testing. Those who pay more attention in class seem to like math better and therefore develop their skills better.

I asked Miguel if his pre-service training gave him any assistance in working with students of different ethnicities. He replied that his experience in his behavioral science degree gave him a better foundation in working with students from different ethnicities. He said that he received sheltered instruction training in another district that has been helpful in dealing with students from Mexico. He shared that it is really a "conglomeration" of different strategies that are gleaned from various sources that can be applied to working with students from various ethnicities.

Miguel stated that in-service training did little to train how to meet the needs of various groups of students. He said: "a lot of the in-service we got, especially in the previous years, were not what they needed to be." He felt that the curriculum that they were given did not meet the needs of the students. Because of this, he tailors home-made activity sheets to student needs. He developed word problems that were similar to ones found on the state assessment. He asserted that the professionally made material does not have enough of the kind of problems students will get on the state assessment.

Views on teaching.

I asked Miguel about his views on teaching. I specifically wanted to know his philosophy of teaching, what he likes best and least about teaching, some of the positive and negative interactions he has had with students, and some of the challenges he has faced.

***Philosophy of teaching*.** Miguel's philosophy of teaching is that every day he wants to do his best. He says: "I want to come in and teach more to my kids because every day I want to challenge all of them. I want them to expect a little bit more from me." Miguel stated that if he can give them something extra, a little bit above their level then perhaps he can inspire someone to say "I learned this and I didn't have to." Miguel stated that when he was a student, he wanted to take every ounce of knowledge from his

instructor and he wants his students to have that same attitude, to take every ounce of knowledge that he has to give.

According to Miguel, excellence in teaching starts with him. It begins with his attitude, is he positive and enthusiastic in his efforts? He said he thinks he learned that from some of his teachers. They had a love for their subject and showed enthusiasm in their teaching. Because of this, they encouraged Miguel to want to learn. He feels that that enthusiasm is the first thing he tries to bring to the classroom. Another thing an excellent teacher does is to make students want to work hard and to succeed. Miguel said that he had one teacher who taught him: "I want you to strive and when somebody says you can't I want you to work harder every time." He said he listened to his message to work hard. He became the top UIL student and he said it was that that taught him about making an effort. He said he tries to teach that to his students. He wants them to change their identity from "I'm lazy" to "I'm a hard worker."

What Miguel likes best and least about teaching. Watching students succeed is what Miguel likes best about teaching. He shared that it is fun to see them go from "I hate math, or I'm not good at math" to being very successful. He said he enjoys the process of building up their skills and self-esteem. He shared that it feels good when, especially years later, students come back and say "thank you Sir, you taught me a lot." Miguel especially noted a student who had "emotional issues" turn into a good citizen and become successful academically. "It's nice to see that change and that's when I say to myself, if I was able to help only one kid, it's worth it."

The district paperwork required of teachers is what Miguel likes least about teaching. A second thing he dislikes is the meetings they are required to attend during his conference time. He said he would rather be supervising his students who are tutoring in his classroom during his conference time.

***Positive and negative interactions*.** A positive interaction occurred between Miguel and a student when he was standing in line with the fourth and fifth graders and he looked at the fourth grade teacher and said "where are my future fifth graders?" One

of the fourth grade students said: “Are you going to be my teacher next year?” And one of his fifth grade students replied that: “Yes, he’s going to work you hard but you are going to learn a lot.’” Miguel said seeing the students enjoy the hard work and learning is very gratifying. Other positive interactions occur when Miguel tries to build up student’s self-confidence. He says that many of the students are not accustomed to working hard; to putting in that extra effort. He tries to develop their perseverance and tenacity to stick with something even though it is hard.

Difficult interactions occur when students are struggling with anger management or personal problems. Miguel stated that when students have difficulties with managing anger it is difficult to focus their attention on learning. “It’s not because they lack the intelligence to do the work but that they are detached from the subject.” Miguel said he can identify with them because his parents had marital problems when he was growing up and he was not focused on school subjects. He tries to make time after class to redirect them. He tells them that “if your parents divorce you need your education. If they don’t divorce you need your education. So I can make it seem that there is some logic in the need, of the goals that you have for them.”

Challenges. One of Miguel’s biggest challenges is that “the work ethic is not there.” He related that sometimes the parents feel that he is putting too much pressure on the child by requiring them to learn mathematical concepts.

> So there is some resistance from the parents and some resistance from the kids because like I said, they’re not used to working hard. That’s a big factor. The work ethic is not there. Even the top students, the work ethic is not there.

Miguel stated that the students don’t see themselves as hard workers and many of them are not motivated to learn. Miguel believes that many of the students have parents who are hard workers. But the parents are so busy trying to earn a living that they don’t have time to push their children. Miguel tries to tell the students: “hey, your parents are hard workers, you need to be a hard worker too.” He said he wanted them to attach their identity to the effort that their parents made.

Views Concerning Students and Parents

Miguel believes that is important to recognize similarities between himself and his students and to point these out to his students. One way that Miguel learns about his students is through a writing assignment he gives them at the beginning of the year. They are to write about themselves, who they live with and how they get along. Miguel shares with his students that he came from a family that was very poor. This enables Miguel to identify with his students and serve as a role model for them. If he could achieve, so can they. He says he tries to point out that it is a team effort. "We're in the same boat, we are a team. We are a school. It's not just that you have to work hard but we all have to do it." He said he always tries to give students an orientation to appreciate the family values. Many of his students are not used to working hard, they don't know the value of earning something. Miguel teaches them that they have to work hard to earn good grades. Also in cases where there is a father figure missing from the home, Miguel tries to help fill that role by offering students complements that make them feel wanted and loved. For example, he might say to a student: "If I had a son I would want him to be just like you." He wants to play a bigger role in their development. He says his job is to teach them mathematics but he wants to teach the whole individual.

Miguel tries to personalize instruction by looking at students' strengths and weaknesses. For example, before they went into improper fractions he was already familiarizing the students with them by saying:

> When you have 23 ÷ 2 it is the same as 23 halves because they are more familiar with that and it is easier for them to multiply. Two times what is 23 without going over. Two x 10 = 20; they take it in steps so that they can become more familiar with it.

I asked Miguel what the characteristics of a good student were. He responded with an example of one of his students. He said that this student is bright, sharp, and sure of herself. At the beginning Miguel could see that this student had talent but she lacked confidence. He said he "took her through the steps and soon enough she began to say: 'well, I wasn't good at math until now.'" Another characteristic that Miguel mentioned is

that a good student has learned to be a hard worker. They may not be as good as they could be, but they understand that if they work hard at it and are consistent they will be able to be successful. “So it’s a mind building process. All I want is somebody that is going to be a hard worker and consistent. They don’t have to be the best, but they will get there.” Miguel offered the example of one girl who scored low at the first of the year, but with effort she was able to score in the 70’s on the latest benchmark exams. “Many of the students dropped about 20 points, so for this girl to get a 70 says a lot.” Another girl also scored low at the beginning of the year. She came from an all-Spanish speaking family and her English reading comprehension skills were not very good. But she was able to score in the 80’s on the latest benchmark test. Miguel predicted that by the time they take the state assessments she would do very well.

Some of the characteristics of students who are not doing well in class are lethargy and being sleepy. Miguel surmises that in those cases there is something going on at home. The students don’t seem to have any discipline or supervision at home. Miguel has called in he parents for a conference, but nothing changed. Miguel feels that the parents don’t put a high value on education. He tells the parents: “This is one of the highest poverty levels in the United States and one of the lowest education levels. We need to change that. I like them to be aware of it.” Another one of his students is a “recent transfer from Spanish to English.” He has had five years of instruction in Spanish and he still hasn’t mastered the Spanish or the English. But, Miguel says, he has made great strides.

> On some occasions he can whip some of my lower kids. He is beginning to use his strategies which is nice to see. But I told him, look, I know that you didn’t pass but that was an excellent effort.

For a beginning student in Spanish and English he is working hard. So Miguel expects that he may be able to pass the math which is a “humungous stride.”

Some of the factors that Miguel named as influencing how well students do in school were that some of the students come from lower performing schools, the student’s

own motivation, and parents attitude toward education at home. Miguel stated that some of the students who struggle in math come from lower performing schools. They had high grades in their previous schools but their skill level didn't match. Many of the parents have said that they don't understand what the problem is since their student always gotten good grades before, but Miguel said that these students are working at a lower level. Another factor is that student's own motivation influences how well they do in school. Some of the students are not motivated to do well. They don't want to do the homework, and if they do the homework it is just filling in an answer. Thirdly, parents' attitude toward schooling affects student performance. Miguel said: "Don't get me wrong, some of them [the parents] are not helpful. But a lot of them do want their kids to succeed and therefore encourage them to do more."

What students need most to be successful. Motivation and self-esteem are two main ingredients of success that students need most according to Miguel. He averred that it is difficult to get students to be self-motivated and to have self-esteem when their math skills are low.

> There are some who are way below the expectation level. That means we have to build them up. It takes a lot of self-esteem. We have to do self-esteem building. Some of these kids require a whole lot more kudos, a lot more motivational strategies.

One way Miguel builds self-esteem is to "break difficult material down to a lower level. You put two simple skills together." He says the idea is that you want them to experience success. When they become successful they start liking it and that builds their self-esteem and motivation.

Miguel holds high expectations for his students. Students need to know that there is always something more to achieve. Any time they achieve something the standard gets raised. There isn't any room for complacency. Miguel wants students to feel, "ok now I got here now I need to do something." He says his premise is that he wants to build self-disciplined self-directed learners. But they have to "taste" success in order to want to be successful. He tries to promote friendly competition. He wants students to think:

> ‘You’re my friend and I am going to try my hardest to beat you. But by me pushing myself we are both going to be successful. We’re going to push each other. And we can compete with each other without having to hate each other.’ I encourage teamwork effort which is something they need in life.

Miguel does try to interject personal values in his teaching so students can see that they need to be respectful, they need to be mindful. He teaches them that their attitude applies to everything. Whether you have to work hard for mathematics or reading your attitude applies to everything in life. He is attempting to teach life values. He tries to teach respect, reverence toward education, being positive, working hard, and doing your best at all times.

Working with parents.

Miguel offers the following example of how a negative parental interaction turned into a positive one. He said some parents would come in angry. They would say: “My kid tells me that you are picking on him.” And Miguel would tell them: “your kid is talking and not doing their work or they are doing something they’re not supposed to.” And then he would ask the child to tell him what his last benchmark score was. The child said 82. Miguel asked: “are you happy with that score?” He said he always asks the student: “when you’re doing the right thing, when you are doing your work do I get after you? Student: “No.” “How come?” Student: “Because I am doing my work.” Miguel said he wanted the student to acknowledge what the correct activity should be. The parents calmed down after that.

An example of a difficult interaction with a parent occurred when a parent came in upset emotionally because her daughter was getting low grades in math. The parent said she should be getting higher grades because she was doing the homework with her every day. Miguel told the parent he was glad she was doing the homework with her, but her last benchmark score was in the 50s. He told the parent that she was not applying the strategies. He asked the student what she was supposed to be doing. She replied that she was supposed to apply the strategies. Miguel tries to make the students and the parents see what they are supposed to focus on.

Miguel shared that he tries to keep in contact with the parents. He tries to maintain phone contact with them or if he sees a parent picking up their child he tries to say "hi" and let them know how their son or daughter is doing; if there are any concerns. He tries to share positive feedback along with the negative because he says it is important for parents to hear the positives too. Miguel also tries to make home visits. He shared that he had one student who was a good student but who was "hanging around with the wrong crowd." He tried to pay a home visit but it backfired because Miguel said the father was jealous of the attention the child gave him. The father even complained to the principal that he had made an inappropriate home visit. In spite of that, Miguel has continued with his home visits. Most parents respond appreciatively.

Miguel says of the parents that some are not helpful but there are quite a few of them that do want their children to succeed and therefore encourage them to do more. He says that parents from the traditional Hispanic culture really encourage their children to come to school and to educate themselves and improve themselves. But there are those parents who are complacent, or who don't push their child, and the students' attitudes reflect that. Miguel said that what he tries to do is to change the students' attitude and build a "yearning for learning as opposed to the attitude of 'so what.'"

Miguel asserted that "your traditional Spanish people don't read." He said he tries to get the parents involved so they will read. "So they can understand that they do need the English language." It is difficult because some of them only speak Spanish. Miguel stated that some of the parents only watch the novellas on T.V. and they know everything that is happening in the soap opera but they will not take the time to read. The students in turn are not as open to reading. Miguel stated that that is one of the most difficult jobs; to get them to read. It is important because reading is required in math as well. Another thing he says they try to deal with is the complacency on the part of the parents. "Sometimes the work ethic on the part of the parents is not there and this is reflected in student's attitudes." He also says that the tenacity is not there that you see in the Asian communities where they are very focused on education and have a high regard for it.

"They don't have that here as much. The students are focused on immediate gratification and are not used to delaying gratification which is essential in education."

I asked Miguel how he works with the students whose parents don't seem to value education. He replied that he tries to give them extra help. He tries to look at their strengths and weaknesses. He tries to pair them with someone who is motivated; someone who can give them a good leadership example. He says that if struggling students associate with someone successful they will begin to improve.

A Typical Mathematics Lesson in Miguel's Classroom.

In the following section I put forth the features of math instruction Miguel utilized in his classroom. I begin with the classroom context of an average day in Miguel's math classroom. I then go on to advance the aspects of her math instruction that he used on a regular basis. Miguel used a variety of strategies to teach math to his students.

***Miguel's classroom*.** I entered Miguel's classroom at the end of his conference period. The classroom was empty except for a few students who were engaged in peer tutoring. Standing in the doorway, to my right is a counter top that holds four computers.

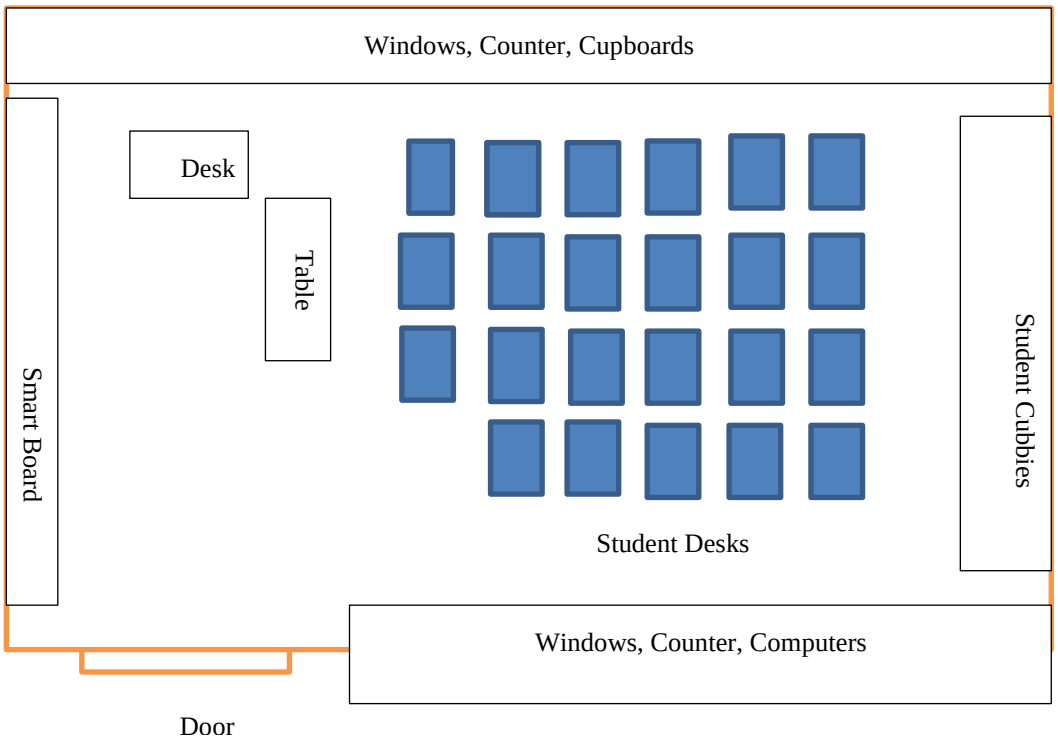


Figure 7 Miguel's Classroom

Above the counter are three wide windows that look out into the hallway. To my left is the front of the classroom. A smart board screen covers a white board in the center of the wall. On either side of the screen is a bulletin board. The one nearest me holds a chart of prime and composite numbers with prime numbers written in red and composite in blue. The other bulletin board is above Miguel's desk which sits in the front left corner of the classroom and holds calendars and n[redacted]es.

His desk holds his computer [redacted]papers. Beside his desk is a table that holds the document reader and more papers. In front of me is a wall with several tall windows that look outside. Below the windows is a counter top and below the counter top are cupboards. The counter top holds boxes and books. The back of the classroom is taken up with students cubbies. The cubbies hold students back packs, coats, sweaters, books, and papers. Student's desks are arranged in rows and take up the center of the classroom. Miguel left the classroom to pick up students from P.E. He returned in a few minutes with his students. They came quietly into the classroom and took their seats.

The lesson that day was on metric units. Miguel began the lesson by saying that in the number three, the decimal is understood to be there as in 3.00. He put problems on the smart board for students to answer. One problem was 3.97 x 100 = 397. He pointed out that you move the decimal two spaces to the right. Another problem was 3.5 x 10 = 35. Miguel put problems on the board that had to do with multiplying decimals by 10s, 100s, and 1,000s. He called students up to the board to work the problems. He said: "I want you to explain what you are doing, you are the teacher." One problem was 49.5 x 100. A student correctly worked the problem by

writing down 4, 950.0. Miguel wouldn't allow the students to simply write down their answer. They had to show and explain how they got the answer. Miguel explained that in doing metric units, we only use multiples of 10, 100,or 1,000, e.g. 3 x 100. The decimal

is understood to be at the right of the three. You move the decimal two places to the right and you have the number 300. The next problem was division by 10; 7, 853/10 = ?

Miguel: Are you making the number bigger or smaller?

Students: Smaller.

Miguel: So you move the decimal one place to the left. The new number is 785.3. or 785 and 3 tenths. (The next problem was 23 x 10).

Miguel: Are making the number bigger or smaller?

Students: Bigger.

Miguel: That's right because we are multiplying. (The answer was 230). Let's have somebody go up there. But I want to hear you explain what is happening.

A student came up to the board and worked the problem 63 x 10. He worked the problem correctly as 630. One student said the answer was 600 and 30. Miguel corrected him by saying that the word "and" meant the decimal point. Another problem was 6.08 x 10; 6.08 becomes 60.8 or 60 and 4/5ths. The next problem was 23.82 x 10. A student came up to the board and correctly worked the problem as 238.2 or 238 and $1/5^{th}$. Miguel put three more problems on the board and had students come up and work them. The students worked the problems correctly with very little coaching from the teacher.

Miguel used the Spanish language to teach math concepts. He wrote centa on the board. He said:

> *Centa* refers to 100. Centavo comes from the Latin. Spanish comes from the Latin. Cents; it takes 100 cents to make a dollar and a century is 100 years. *Cien* means 100 in Spanish. *Centi* means 1/100. These are your units. Centimeters and meters. One centimeter = 10 millimeters. One meter = 100 centimeters. One meter is about 3 inches more than a yard. *Centi* and *centa* mean something different based on the i and the a. Like niño and niña. Totally different based on the *o* and the *a*. Centa is 100/1 and centi is 1/100. One meter equals 100 centimeters and one millimeter equals $1/10^{th}$ of a centimeter.

Miguel drew a T chart on the board with centimeters on the left and millimeters on the right. He asked the students how many millimeters in 8.3 centimeters. The students replied: 83.0. Miguel then wrote several problems on the board for students to work individually. After several minutes, Miguel called on students to answer the problems. Miguel then had the students work several problems having to do with days, months, and years. One problem was:

1. One minute equals $1/60^{th}$ of an hour,
2. One minute equals 1/12 of an hour, or
3. One hour equals $1/60^{th}$ of minute.

The correct answer was one minute equals $1/60^{th}$ of an hour. Miguel then went back to problems with metric measurements. One problem was: 14 millimeters equals how many centimeters? Miguel encouraged his students to make a T chart with centimeters on the left and millimeters on the right. He said: "One centimeter equals 10 millimeters. So you divide 14 by 10. The answer is 1.4 centimeters or 1 and 2/5ths centimeters. Miguel: "3.2 centimeters equals how many millimeters? What is 3.2 x 10? You move the decimal one place to the right so that's 32 millimeters." The next problem he gave the students was 7.9 centimeters equals how many millimeters? Student: 79. Miguel: "excellent." Another example was 8.3 centimeters equals how many millimeters. "Multiply by moving the decimal one place to the right." Student: 83.

> When you multiply, you are increasing so you move the decimal to the right. When you are dividing you move the decimal to the left because you are decreasing. If you divide 8.3 by 10, you move the decimal one to the left so 8.3 becomes .83.

Miguel then put several more problems on the board for the students to work. They worked on these problems to the end of the period.

Features of Math Instruction Utilized by Miguel. Miguel used a variety of instructional strategies to teach his students. The following patterns or themes were derived from all observations combined and they represent the most frequently occurring features of Miguel's math instruction. The strategies include: reviewing previously

learned concepts; making learning comprehensible; teaching through music, rhymes, movement, and visuals; collaborative group work; motivation and engagement; and supports for struggling learners.

Reviewing previously learned concepts. Miguel often reviewed previously learned concepts with his students before introducing a new lesson. Miguel generally approached reviewing previously learned material in two ways. They were using activity sheets and working on the board.

Using activity sheets. Miguel used activity sheets only occasionally while I observed him. Activity sheets were generally used to reinforce and review already learned concepts. Miguel related that CSCOPE lacks practice with the concepts. It generally had too few problems for the students to work to learn a concept. Therefore, Miguel often made up his own activity sheets. He said: "I developed my own activity sheets so the kids could have more practice with certain concepts."

An example was an activity sheet that had to do with finding common factors of numbers and included prime and composite numbers and their factorization. One problem was:

"Which sentence about the number 47 is true?

A. It is composite because it has more factors than one and itself.

B. It is prime because it has only factors of one and itself.

C. It is composite because it has a factor of one.

D. It is prime because it has a factor of seven."

The students correctly identified the answer as B.

Another activity sheet involved finding yards, feet, and inches. One problem was: "One yard equals 3 feet so 13 feet equals how many yards." The answer was 4 yards and 1 foot or 4 1/3 yards. Another question was "what is 65 feet in yards?" The students worked out the answer to be 21 2/3 yards. A further problem had students convert 20 inches to feet. The students found that 20 divided by 12 equals 1 2/3 feet. A final

question had the students convert 4 feet to inches. The answer was to find the product of four and 12 or 48 inches.

Working on the board. In a lesson reviewing what they had done the previous week in comparing fractions and improper fractions Miguel wrote 5/8 compared to 10/16 on the board. He said that you can multiply 5/8 by 2 and get 10/16 so the fractions are equal. Miguel asked "who can tell me something about improper fractions?" A student volunteered "the top is bigger than the bottom." Miguel: "the first thing you need to remember is that this is more than one. The definition of an improper fraction says that is has to be one or more." Miguel reduced a fraction to 5/4 and asked the students what that would be. The students said they didn't know. He said "I taught you this last week." He finally told them it would be 1 ¼. Miguel: "What would 9/8 be? Students: "1 1/8" Miguel put 6/5 on the board. The students responded that it would be 1 1/5. Miguel next put 8/5 on the board and called on a student to answer. The student said he was not sure. Miguel said 5/5 plus how many more. The student responded 3/5. Miguel put 1 3/5 on the board.

In one instance I observed Miguel reviewed the order of operations with the students. He wrote on the board: PEMDAS. He said: "parenthesis first, next exponents, next multiplication, next division, then addition then subtraction." Miguel put $4^2 + 8$ on the board. He asked his students:

Miguel: Are there parenthesis?

Students: No.

Miguel: Are there exponents?

Students: Yes.

Miguel: What do we do first?

Students: 4 x 2 or 4 x 4.

Miguel: Four to the power of two means four times itself.

Students: 16 + 8 = 24. (Miguel next put on the board $3^2 - 1$ = what?)

Students: 8.

Miguel: What about 3^3 - 5 = ? 3 x 3 x 3 = what?

Students: 27.

Miguel: Minus 5 equals what?

Students: 22.

To review a lesson on changing feet to inches and inches to feet, Miguel said: "We are going to review how to convert units. We're going to use standard units first, English units: inches, feet, and yards." Miguel drew a T chart on the board and directed his students to make a T chart with the bigger unit on the left and the smaller one on the right. Miguel wrote *feet* on the left side of the T chart and *inches* on the right. He asked his students: "what are we going to write under feet?" Students replied: "one." Miguel: "Right, and what are we going to write under inches?" Students: "12." Miguel: "The number of feet times 12 will give you the number of inches. If they give you 36 inches what are you going to do?" Students: "Divide by 12." Miguel: "Suppose I want to know what 9 feet is in inches; nine times 12 = 108 inches. Let's say one of my students is 73 inches tall and I want to know in feet how tall she is." Miguel filled in the T chart. One foot equals 12 inches, two feet equals 24 inches, three feet equals 36 inches and continued up to six feet equals 72 inches. So a 73 inch tall student would be 6 feet 1 inch tall or 6 and 1/12 feet tall. Miguel: "What would 38 inches be in feet?" Students: 3 feet and 2 inches or 3 1/6 feet.

Making instruction comprehensible. Miguel utilized three main ways to make instruction comprehensible to the students. They were using the Spanish language, making sure that students had to solve at least some problems independently, and making sense of new information.

Using the Spanish language. Miguel used the Spanish language as a point of reference for his mostly Spanish speaking students. The language served to make a connection between something familiar to students and new concepts. He said he does bring the Latin language into focus because a lot of our words are Latin based. For example, in a lesson on combinations Miguel used the Spanish word *combinar* (to combine) to illustrate the concept of putting different things together. He said:

"Combinations; what's a combination? *Combinar*, different things that you put together." He wrote "combinations" on the board. He asked his students what combination meant. He said: "You cannot use the same word to define it. You cannot say addition is to add two numbers. *Combinar,* take different things and put them together."

On another occasion he used the word *primo* (cousin) to illustrate a concept in prime numbers. He started the lesson by asking his students what prime numbers were. One student offered that "you can multiply it by itself and one." Miguel: "ok, a number that has only two factors. You can multiply it by itself and one." He told the students that this is something related to their own culture. In the Spanish language you have something called a *primo.*

Miguel: If my *primo* and I go shopping to the mall how many people are going shopping?

Students: Two.

Miguel: Only two people. Prime numbers have only two factors." Somebody tell me about a composite number. The word composite comes from the Latin word '*compuesto*.' If something is *compuesto* (composed) what is it?

Student: It has different parts.

Miguel: Yes, it is composed of different parts. Composite numbers have to have three or more factors. If a number has 3, 4, 5, or 6, factors is it prime or composite?

Students: It is composite.

Miguel: Zero and one are not prime and not composite. How many factors does one have?

Students: One.

Miguel: That's right. For your homework I want you to color the prime numbers on your hundreds chart in red.

In a lesson on converting feet to inches and inches to feet Miguel asked his students what "*cambio*" meant in Spanish. Students replied that it means to change. They were going to change feet to inches.

Working independently. Miguel often had students work problems independently before calling on a student to come to work the problems on the board. During a lesson on combinations, Miguel worked several problems on the board and then had the students try some independently. One problem he had them do independently was to find the number of combinations possible of six vases. Another example involved four categories with three or four choices in each that he presented as 3 x 4 x 3 x 3 showing a mechanism for finding the total number of combinations possible. Another example dealt with food with choices of meat, vegetable, drink and desert. In a final example, he wrote 11 types of food and drink on the board. The students had to put the food into categories and solve for total numbers of combinations. This generated a lot of enthusiasm and was fun for the students.

Miguel put several reducing fractions problems on the board. The students were to work them independently before he asked a student to come to the board and work them out for the class. One of the problems was 18/36. A student came to the board and wrote ½. Another problem was 4/6. Miguel said: "tell me about these two numbers." Students replied that they're both even and you can divide them by 2 so the solution would be 2/3. Miguel said: "we'll give you some easier problems like that so you can build up your confidence." Miguel gave them three other problems to solve independently before calling someone up to the board. One was 8/10 or 4/5. Another was 14/28. A student came to the board and wrote ½. The last one was 30/90. A student came to the board and wrote 3/9 then with coaching reduced it to 1/3.

Making sense of new information. Miguel tries to help his students make sense of new information in several ways. One, he will use analogies, two he will try to make a connection from what they already know to something new, and three he will try to help students break down more difficult information into smaller pieces. For example, when

teaching about prime numbers, he said he will use the analogy of antonyms or opposites. "You're either prime or not prime which would be composites." Miguel uses what students already know to learn new concepts. For example, one student was having difficulty with the problem A-7 = 3. Miguel said: "Let's use numbers that you understand. A is unknown. If we substitute 10 for the unknown then the answer is three." He had them use other simple expressions. He said: "I always teach them to use what they know." Finally, Miguel tried to break new information down to a simpler level or scaffold it. If he sees that they do not understand it, he will try to break it down in a different way. He will continue to give them examples until they are able to grasp the concept. He says:

> It's not that the concept is that difficult, it's just that they are not familiar with the format of the problem. That's one of the premises that I talk to them about is becoming familiar with the material. Sometimes is sounds or looks abstract but it's really not that complicated. So I try to break it down in a simple way. The more exposure they have to they type of problem it is the easier it becomes because they become familiar with the format of the problem.

Teaching through music, rhymes, movement, and visuals. Students learn through using different learning pathways such as music, rhymes, movement and visuals. The two pathways Miguel used most were visuals and hearing. He often used visual aids and solving problems on the board during his lessons.

Using visual aids. Miguel stated that it helps students when they have something concrete to visualize concepts. Especially doing geometry they need to be able to visualize and see the dimensions. "They need to be able to see that these objects are a rectangle and a square prism. It helps them be able to make a connection." Another thing visuals help with is that students are used to changing attention from one thing to another. Miguel feels that he is allowing them to change attention from the written paper to something concrete. He believes it "helps keep their minds from wondering off." Miguel offered that technology in the classroom such as the smart board gives students visuals. He said he hadn't use the old chalk board in years. "The smart board allows you to draw

in different colored inks, different designs, circle the word in a different color. So it does give them a lot of the visual."

As a visual aid, Miguel had his students create a prime factorization chart and multiplication table. Miguel wrote down even numbers on the chart. He then factored the composite numbers. Then he went back and wrote in the odd numbers circling the prime numbers and factoring the composite numbers. For example, Miguel wrote 2, 4, 6, 8, and 10 across the top of a piece of paper. He circled the two and factored the rest. Then he went back and added the odd numbers to the row and circled the prime numbers e.g. 3, 5, and 7. He continued in like manner to the number 60. There were several patterns on the chart that Miguel pointed out to students. Miguel told his students to put the paper in their binders where they could refer to it later.

To help his students learn the prime numbers, Miguel held up a number chart with numbers to 100. The prime numbers were written in red and the composite numbers were in blue. Miguel wrote down the prime numbers form one to 47 on the smart board. He told the students that they were going to write them 10 times for homework. He then passed out a hundreds chart on a piece of paper to each student. He said: "We will use this when we get to fractions. You will know whether or not you can simplify fractions based on prime numbers." Miguel had the students color in the hundreds chart in red for the prime numbers and blue for the composite ones. Miguel next put a hundreds chart on the document reader with all the prime numbers in red and the composite numbers in blue. He had the students recite the prime numbers chorally. He said: "If they ask you if a number is a prime number, you will know. Why? Because you know your prime numbers."

Solving problems on the board. Miguel used the white board or the document reader every day that I observed him. He gave students the opportunity to work problems on the board individually and he used the board to model problem solving to the class.

Individually. Miguel frequently had students come up to the smart board or the document reader in the front of the room and work problems. He said he does that

because it builds student's confidence and they enjoy it. "I want them to develop the confidence that they can do it. So it's building their confidence. It becomes fun for them." He wants students to "come out of their shell and not be shy." When students come up to the board, he tries to give them problems that are at their instructional level. "If you are not a high level student, I'm not going to give you a way higher problem that is above your level." Sometimes the students will say: "well, that was easy." But he says he wants everyone to have the opportunity to build success. "You can only build success by being successful. So that's what it is, stepping stones."

During a lesson on equivalent fractions, Miguel had students come to the smart board and work problems. One was *5 ¾* or 5 x 4 + 3 = 23/4. Miguel said: "by the way, how much would that be in money?" A student replied "$5.75." The next problem was *4 2/5*. Miguel called on another student to come to the board and work this one. The student wrote 4 x 5 + 2 = 22/5. The next two problems were *6 2/3* and *5 3/7*. The students worked these out individually on paper then Miguel had students come to the board and work them out. One student wrote 6 x 3 + 2 = 20/3. Miguel: "That's right, excellent." Another student wrote 5 x 7 + 3 = 38/7. Miguel put six similar problems on the board for the students to work individually first then he called on students to come to the board to work them out.

In another instance when Miguel was teaching reducing fractions, he first worked several examples on the board. Then he called up individual students to come to the board and work problems. One problem was *19/18*. The student correctly reduced it to 1 1/18. Miguel then put up more problems for the students to work individually before he called on students to come up to the board and work the problems. Another problem was *4/6*. Miguel showed the students that it can be reduced to 2/3. Then he put *8/10, 6/8*, and *10/12* on the board for students to work individually before he called up students to work them on the board.

At times Miguel used the document reader rather than the smart board. On a lesson on finding the common factors of numbers, Miguel showed the students how to

get the factors of 12 and 36 using factorization. For example, the factors of 12 are 1, 2, 3, 4, 6, and 12. The factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18, and 36. The common factors are 1, 2, 3, 4, 6, and 12. Miguel then called on a student to come up to the document reader and find the common factors of 24 and 48

Teacher modeling. Miguel frequently introduced new concepts by modeling examples on the board. For example, in a lesson on combinations, Miguel wrote four words describing types of vases on the board: gold, silver, crystal, and pewter. He said he liked to use A, B, C, and D. "I want to see how many combinations I can make of two. The first combination we can make is A and B. Next A, C; and A, D." He wrote the combinations on the board. "How many combinations per letter?" Students: "three." Miguel: "how many letters?" Students: "four." Miguel wrote on the board 3 x 4 = 12. "You can have 12 combinations." Miguel said they were going to do a real life situation. They were going to provide the staff with breakfast tacos in the morning. He said he was buying the tacos and they each had two ingredients. The ingredients were potatoes, egg, chorizo, and bacon. "So let's make all the combinations. You are allowed to put two ingredients on your taco." Miguel wrote all 12 combinations on the board: pe, pc, pb; ec, eb, ep; cb, cp, ce; bp, be, bc. He said "if we take out all the duplicates, we have one half of the combinations."

During a lesson on the divisibility of numbers, Miguel wrote "divisible by three" on the board. He told the students that he was going to show them a "trick" so they would be able to "get it done faster." The trick was to add the two digits in a given number together and if it can be divided by three then it is a multiple of three and three is a factor of that number.

> For example take the number 16; add the two digits together and divide by three. 1 + 6 = 7 and seven divided by three is 2 R1 so 16 is not a multiple of three. Next take the number 25, add the digits together and get seven. Seven divided by 3 is 2 R1 so 25 is not a multiple of three. Try the number 72. Add the digits and you get nine. Is nine divisible by 3? Yes, so 72 is a multiple of three. By the same token, three is a factor of 72. Another number we can try is 93. Add the two digits together and you get 12. Add the one and two together and you have three. Is

three divisible by three? Yes, so 93 is a multiple of three and three is a factor of 93.

Miguel worked several more similar problems on the board.

Collaborative groups. Miguel stated that some of the classes work better in groups than others. He said the group I was observing tended to talk a lot sot he didn't do as much with groups with them. In an instance when Miguel used groups in the class I was observing, the lesson was on finding the difference between two squares of unequal size. First he had the class figure the area of both squares. One square was 10 x 10in. and the other was 7 x 7in. Miguel showed the class that to find the difference do 100 – 49 = 51 square inches. Then he showed them the middle school way to work the problem. He wrote on the board: $10^2 - 7^2$. He said to find the difference between a square and a shaded area inside the square, find the area of the bigger one, find the area of the smaller one, and then find the difference. He told the class he was going to teach them two ways to do it. One was the fifth grade way and the other was the middle school way. The fifth grade way was to take 10 x 10 and subtract 7 x 7. The middle school way was to write the problem $10^2 - 7^2$. Miguel then had them work in groups of four to find the answer to several problems of having two squares of different sizes. The first squares were 10mm. and 6mm. Miguel gave the students 5 minutes to find the answer the fifth grade way and the middle school way. Miguel moved around the classroom and helped where needed. After a few minutes he said: "one more minute and I'm going to have Carolina's (pseudonym) group get up there and explain." One student from Carolina's group came up to the board and wrote (10 x 10) – (6 x 6) = 64mm² and $10^2 - 6^2 = 64mm^2$. Another problem he gave them to work was two squares that had the dimensions of 10 x 10 mm. and 4 x 4 mm. After a few minutes Miguel had a student come to the board and work the problem. The student wrote on the board (10 x 10) – (4 x 4) = 100 – 16 = 84mm². He also wrote $10^2 - 4^2 = 84mm^2$. A final problem was a square of 12 x 12 cm and a square of 8 x 8cm. A student came to the board and worked the problem (12 x 12) - (8 x 8) = 80cm².

The student also wrote $12^2 - 8^2 = 80cm^2$. Additionally, this student wrote $(12 + 8)(12 – 8) = 80cm^2$.

Motivation and engagement. One of the ways Miguel motivates students is through giving complements. Miguel has students stay in during P.E. to engage in peer tutoring. He says some he has to ask to stay in and some of them stay in on their own. He said:

> And that's great. And I complement them in front of the class. I want them to see, that it's not just an extrinsic reward; here's a candy at the end of the day. I want them to feel good that they are doing something for themselves.

If students understand something Miguel is trying to teach, sometimes they will come up and show him their work and Miguel will give them a compliment such as "great job" or he will give them a thumbs up or sometimes he will say '"why do I even need to check your work?' They know that that's a great compliment. It's equivalent to a hundred."

Miguel encouraged his students to do their best work through what he calls "friendly competition." He said that sometimes he will snap his fingers and the students know that he wants them to answer as quickly as possible. He said:

> I try to get them to beat the others. So I develop the competitiveness but I've always told them I want them to compete in a friendly way. You know, "you beat me this time, but I'll try to beat you next time" But it's not a combative type of way. But it's a friendly competition. That's what I call it.

One of the reasons Miguel identified he was a successful teacher is that he tries to develop in his students the desire to accomplish more. He related that he has a student, who he does not consider as one of his top students in terms of talent, who has gone from an average student to be one of the top students in UIL. He said that this student achieved a third place win against some of the top students in the valley. Miguel reported that this student is working hard right now because they have a district meet coming up. "But from not having UIL before to have him step up that high. I think it's wonderful. He embodies what I want my kids to accomplish; to search for." Miguel also introduces simple algebra to his students. Not because they need to know it in fifth grade, but

because he wants to challenge his students to want more. Miguel says that his goal in doing this is to encourage students to want to learn and to be self-directed learners.

Supports for struggling learners. I asked Miguel if the majority of his students begin the year at grade level. He responded that many of them are at least two grade levels below. He said they had five groups of fifth graders. Two of those groups were cause for particular concern. He said: "One is very limited English speaking although instruction is in English. The other one reads English but their level of comprehension is not anywhere close to where it should be." He also has several students from each group that "need a lot of attention." Miguel works with struggling students in two ways: small group tutoring after school and individual peer tutoring during his conference time. Miguel said that he finds that students are more comfortable with a peer. So when he finds someone who has the patience to work with a classmate who struggles, he will assign them to work with each other. He said peer tutoring seems to help because it allows for the re-teaching or re-introduction of concepts at a different level; looking at it from a different perspective. Peer tutoring challenges students to improve because they want to be peer tutors. Miguel tells them that if they improve and achieve that proficiency level he will promote them to be tutors. He reported that students push themselves so they can be tutors so it helps both the tutors and the tutees.

Features of Math Instruction that Correspond with Culturally and Linguistically Responsive Pedagogy

There are several of the features of math instruction of the participating teachers that are responsive to student's cultural and linguistic background and personal life experiences. They include making learning relevant, making instruction comprehensible, and using collaborative groups.

Making Learning Relevant

Teachers make learning relevant to their students through two main ways. They were using students' background knowledge and personal life experiences and using real world applications.

Using students' background knowledge and personal life experiences. Mary used iPods for a lesson on possible outcomes. The iPods were something from the students' backgrounds and something they liked. Mary led the students through folding a piece of paper so that there was a diamond in the middle and four sections when it was opened up. She said the previous day they had worked on the tree diagram and the numbers solution. She said that day they were going to do the table and the organized list. She wrote "possible outcomes" in the diamond in the center and tree diagram, numbers solution, organized list, and table in each of the four sections. She wrote "iPods" in the center section with the colors black, red, or silver under iPods. She wrote "case" beside "iPods" and under "case" she wrote the colors orange, blue, and green. She led the students in making a table and an organized list of the possible outcomes.

Sarah's students made a booklet about measurements. They drew examples of familiar objects in their booklet that were of different real life objects that they had measured. For example, some students drew a jolly rancher in their booklet for an example of an inch. For a foot, some students chose to draw a ruler or a textbook. One student drew an arm from the elbow to the hand. For a yard, some students drew a baseball bat or the front of their desks. For a millimeter some students drew a flea, and some drew a grain of rice. For a centimeter some students drew a pencil eraser, others drew a pea and others drew the finger nail of the little finger.

The use of food from student's backgrounds served as a bridge to new concepts. In a lesson on combinations, Miguel said they were going to provide breakfast tacos to the faculty in the morning. He said they were going to use four ingredients: egg, chorizo, potatoes, and bacon. They were going to make each taco with two ingredients. On another occasion when the lesson was also on combinations Miguel wrote four types of

food on the board. They were meat, vegetable, drink and desert. One of the deserts was *tres leches*, a type of traditional Mexican cake. In a final example, Miguel put 11 types of food on the board and the students were to put the food into categories and solve for the total number of combinations.

Amy shared that her most prevalent teaching strategy was using student's background knowledge. She said she "takes it from where they are and goes from there." Amy believes that the knowledge gained outside the classroom can make students "smart." She remarked that you see the students that have a lot of exposure to things that their knowledge is way up there. Not necessarily because they are smarter, but because they have been exposed to more things. She said that "some students seem smarter because of the exposure that they have outside school." Amy tires to activate student's background knowledge before teaching them about a concept. For example, on an introductory lesson on fractions, Amy had her students draw two concentric circles in their math journals with the inner circle labeled fractions. She had the students sketch or write about anything that came to their minds about the word fractions. She said: "Anywhere you have seen fractions can be in your circle map, at your house, at the store, anywhere." In a lesson on telling time, Amy encouraged her students to write down everything they knew about telling time. After giving the students several minutes to write, Amy asked if there was anyone who wanted to share what they wrote. Students shared what they knew about telling time. One student shared that his grandmother had a cuckoo clock.

Eva equated student's backgrounds with lower economic status. She related the story of taking her students to a local university where they got to sit in a large auditorium classroom. The students loved it. On the way home in the bus the students shared that they didn't think they could afford to go to college. The adults on the bus conveyed to the students that they had to have financial aid to go to college. The students were amazed and excited that there was a way to finance college. Eva said to her

students: "…You may think you struggle for different reasons but there is always a way out of whatever it is you are living through right now."

***Using real world applications*.** Sarah made connections to real life in math through several means. In one instance she talked to her students about how to go shopping with a fixed amount of money. How much is involved in making a rent payment every month and how much a car payment is. She talked about how much a person at McDonald's makes, how much a teacher makes, and how much a lawyer makes. She said her students were stunned. They didn't know. She put it in concrete terms so they could understand. Sarah also teaches students to round money to the nearest dollar. She handed out a activity sheet with dollar amounts that were to be rounded to the nearest dollar. For example, Sarah asked her students to round $3.14. The students said it becomes $3.00. In one instance Sarah asked her students if they wanted to go shopping. They answered "yes" in chorus. The students were seated in pairs and Sarah gave each pair of students a flyer from Walmart advertising Halloween sales. She also gave each pair of students a hypothetical $100.00 to spend. They were to round each item they spent to the nearest dollar and see who could be the first to spend $100.00.

Sarah also used pizza as a connection to real life when doing a possible outcomes problem. She said they were going to do the crust, either pan, stuffed, or thin and crispy, a set of toppings pepperoni, cheese, and sausage, and another set of toppings; mushrooms, ham and olives. She made the problem into a story and used students' names in the narrative. She said Mr. Perez (pseudonym) wanted a pan crust pizza with cheese and mushrooms. She then took the students through the steps to make an organized list and a table to find all the combinations possible. She ended by doing the numbers solution which was 3 x 3 x 3 = 27 combinations.

Sarah tied a lesson on rounding money or decimals to real life when she said: "A lot of you can help your parents when you go grocery shopping doing this." She said that was where she applies rounding in real life when she is grocery shopping. She said: "I was thinking how could I help these kids make that connection to real life? I just wanted

to make that life connection for them." "And," she said, "they use it." The students will come and tell her that "they went grocery shopping with their mother and they helped her with the numbers."

During a lesson on multiplication Sarah had her students create their own multiplication problems. She did this because she said she wanted to expose them to real life situations. She said:

> Multiplication is not just black and white. You don't just have 49 x 37. You have the in problems…It's well you have 49 feet of something. A problem is not going to be some numbers and here it is. It's going to be stated in word form…I keep telling them it's not about numbers. It's about somebody's going to tell you something with something whether it's going to be add, subtract, multiply, or divide. Whether it's money, you go to Walmart and it's not going to be can you subtract 30 cents from a dollar. No, it's going to be this is how much it is and this is how much you have left. It's always going to be in story context.

Mary also allowed students to use real life application when she had her students generate their own multiplication problems. They worked in groups of four to create their own problems. An example of one group's problem was: An animal shelter feeds it's dogs three times per day. They have 98 dogs. How many feedings do they give in a day? Another group's problem was: A bookcase has four shelves. Each shelf holds 12 books. How many books were there in the bookcase?

During a lesson on intersecting, parallel, and perpendicular lines, Eva connected the material they were learning to real world situations when she said:

> There is a purpose for us to learning about lines. It's not enough for us to say in the classroom, ok that's perpendicular, that's parallel. A lot of people use these vocabulary words when they are giving directions. For example I can say our school is near the intersection of 9^{th} and Dove. Or we can say that Caesar Chavez road is parallel with Alamo road.

Eva distributed a handout with three pictures of street maps. Eva had students look for examples of the vocabulary words on their maps. For example, she said: "Raise your hand if you can find two streets that are parallel to each other." The students responded: "Exchange Place and Wall Street." Eva then asked students which street was

perpendicular to Broadway. Students replied: "Wall Street." Then Eva directed her students to look for intersecting streets. Students pointed out Exchange Place and New Street. The students were able to make subsequent real world applications with the three vocabulary words when Eva asked them to look around the classroom and find examples of the three vocabulary words. The students identified examples of intersecting, perpendicular and parallel lines in the classroom. For example, a student pointed out that the border around the bulletin board was an example of perpendicular lines.

On one occasion Eva had her students generate their own data for making predictions by playing a basketball game. For example, the boys made 7 shots out of 14 tries, how many shots will they make out of 28 tries? I asked Eva what the purpose of having students generate their own data was. She replied in part that "…it's just to let them know that you don't need someone to give you numbers to be able to perform these concepts…"

Eva indicated that she does try to bring in students home lives into instruction whenever possible. She used the example of a problem where the students were given a hypothetical sum of money and a grocery list and they were asked to use the skill of estimation in order to "spend" their money wisely. She also related math to when their parents pay the bills. She says: "Once we can relate to something they are familiar with then they are like: 'oh, OK"' Sometimes their math program will use terms that the students are completely unfamiliar with, like going to the opera. She said: "They had no idea what that concept means, that's not something they can relate to." She said she tries to find things students can relate to even in simple word problems, she said: "We have to find something they can be familiar with." Eva told her students that as an adult, she has to use math every day whether you are a teacher or whether you are a housewife. She said she does a lot of "you're at the store and you do this, how would you go about this problem? I try to relate it back to their families, how would you apply it in the real world?" In a lesson on division Eva had her students think of real world applications. She said for example: "I have two children, if I have seven cookies could I give all seven to

one child? No, I would have to think about breaking them evenly between two children." In another example she said: "If I wanted to buy lollypops for the classroom and they came in bags of five, how any bags would I need?" Students: "four."

I asked Eva why she used real world examples. She replied that on the state achievement test it's not enough to know what perimeter is, but they have to be able to recognize a real life problem; that the question could be about perimeter without ever mentioning the word perimeter. She says they need to be able to realize that that's what they are talking about without seeing the actual word. So it has to do with the test but also how to apply it in the real world. Eva said:

> A lot of times it's like, "ok, we learned this, is it only for a test?" And I try to tell them: "You're going to use this throughout life. If you want to build a fence around your house you can't just go out and buy materials, you need to know how much" and just so they know how to apply it.

Amy used connections to real life examples to help make learning relevant to her students. During a lesson on fractions, Amy asked the class if they had examples of something that equaled one whole. One student volunteered that five slices of pizza out of five slices of pizza makes one whole pizza. Amy added that if she had 22 out of 22 students make their accelerated reader (AR) goal then the whole class had met their AR goal. During a lesson on telling time, Amy asked her students what some of the real world reasons why it is important to be able to tell time. Students offered: "To know when to get ready for school, to know what time to go to sleep, to know what time your mom is going to pick you up, to know what time to get someplace, to know what time to go to lunch, and to know what time McDonalds closes.

In a lesson on converting inches to feet Miguel applied what they were learning to a real life situation. He said: "Let's say one of my students is 73 inches tall and I want to know in feet how tall she is." Miguel filled in a chart as one foot equals 12 inches, two feet equals 24 inches, three feet equals 36 inches and he continued up to six feet equals 72 inches. So a 73 inch tall student would be six feet one inch tall or 6 and 1/12 feet tall.

Miguel: “What would 38 inches be in feet?” Students: “Three feet and two inches or 3 1/6 feet. “

Correspondence with the culturally responsive pedagogy literature. Geneva Gay (2000) offers the following descriptive characteristics of culturally responsive teaching. She says that culturally responsive teaching is validating, comprehensive, multidimensional, empowering, transformative, and emancipatory. Culturally responsive teaching is validating in that it acknowledges the legitimacy of the cultural heritages of different ethnic groups; builds bridges of meaningfulness between home and school; uses a wide variety of instructional strategies that are connected to different learning styles; teaches students to know and praise their own and each other’s’ cultural heritages; incorporates multicultural information, resources, and materials in all the subjects and skills routinely taught in schools. Gay uses part of Holins (1996) description of education for culturally diverse students in her characteristics of culturally responsive teaching. She stated that culturally responsive teaching is comprehensive in that it “incorporates culturally mediated cognition, culturally appropriate social situations for learning, and culturally valued knowledge in curriculum content” (p. 13). Culturally responsive teaching is multidimensional in that it encompasses curriculum content, learning context, classroom climate, student-teacher relationships, and instructional techniques. Culturally responsive teaching is empowering in that it translates into academic competence, personal confidence, courage and the will to act. Culturally responsive teaching is transformative in that it is explicit about respecting the cultures of diverse students. It recognizes the existing strengths and accomplishments of these students and enhances them further in the instructional process. Culturally responsive teaching is emancipatory in that it makes authentic knowledge about different ethnic groups accessible to students. It is liberating in that it “releases the intellect of students of color from the constraining manacles of mainstream canons of knowledge and ways of knowing” (Gay, 2000, p. 35). Teachers’ practices in this study correspond with the theoretical principles of culturally responsive teaching in several ways. Teachers in this study built bridges between home

and school, used a wide variety of instructional strategies, incorporated culturally mediated cognition, taught substantive content, and built positive teacher-student relationships.

Builds bridges between home and school. Sarah built bridges of meaningfulness between home and school by incorporating home shopping activities in a lesson on rounding to the nearest dollar. She asked her students what *$3.14* would be if it were rounded to the nearest dollar. The students replied that it would be $3.00. Sarah said they could help their parents with the grocery shopping by rounding items to the nearest dollar. Another means of connecting math to home was through a lesson using food as an example. During a lesson on possible outcomes Sarah asked her students how many of them had been to Pizza Hut. Almost everyone raised their hand. She said they were going to put together a pizza with possible combinations. First was the crust, either pan, stuffed, or thin and crispy. Next was the first set of toppings, either pepperoni cheese, or sausage. The third set of information was another set of toppings, mushrooms, ham, or olives. Sarah took the class through the steps to make an organized list, a tree diagram, a table, and the numbers solution to find the solution. Another way to use food as a connection between home and school was when Sarah gave each pair of students a flyer advertising Halloween sales for them to round items to the nearest dollar. The flyer mostly advertised food and candy items. Sarah's students have told her that they have used it. They went grocery shopping with their parent and they helped their parent with the numbers. Sarah gave each pair of students a hypothetical $100.00 to spend. Students worked together to spend their $100.00. Sarah also presented her students with problems about how much people pay for rent, a car payment, and utilities. They talked about how much a person at McDonald's makes, how much a teacher makes, and how much a judge makes.

Amy also used food to make a connection between students' homes and school. A problem on a math activity sheet included a question about toppings for a baked potato. Amy asked her students what a baked potato was. Students volunteered that it was food,

that it was a potato and that it was baked. Then she asked her students to share what kind of toppings they liked on their baked potatoes. Students offered that they liked butter, bacon bits, bacon, sour cream, chili, cheese, and olives. Amy affirmed that knowledge that students gained outside of school makes students seem smarter. She related that the background knowledge the students have from other grade levels and from home plays a big role in what they learn in the current grade. She said:

> And then you see the students that have a lot of exposure to things academically and of course their knowledge is way up there. Not necessarily because they are smarter, but because they have been exposed to more things…some students seem smarter because of the exposure that they have outside school.

Mary made a connection between home and school when she used iPods in a lesson on possible outcomes. She had the students fold a piece of paper so that there was a diamond shape in the middle and four sections on their paper. She wrote iPods in the center of the diamond and underneath the word iPods she wrote the colors black, red, or silver. She then wrote "cases" beside the iPods and under the word cases she wrote the colors orange, blue, or green. She then took the students through the steps to make a table, a tree diagram, an organized list, and the numbers solution to find the possible outcomes.

Eva used the Spanish language to make a connection between home and school. Her instruction is all in English but if she knows she has a predominantly Spanish speaking student, she will translate vocabulary words into Spanish for him or her. In the majority of cases she uses Spanish for clarification purposes only, not to teach the lesson. Normally in fifth grade she does not have students who are testing in Spanish. So when she uses the Spanish for an English language learner (ELL) it is to help them out with the vocabulary. Eva tries to bring students' home lives into math lessons. For example, she said that she uses a grocery list and "gives" the students only so much money to spend. They have to use the skill of estimation to not go over the amount of money they have to spend. She also brings in when the parents pay the bills. How much is a rent payment, utilities, and a car payment. She tries to relate math to things students are familiar with.

For example, in a lesson on perpendicular, intersecting, and parallel lines, Eva passed out a street map to students. They were then to find examples of perpendicular, intersecting, and parallel streets. Eva told her students that there was a purpose for learning about lines. She said it's not enough to say in the classroom that that's parallel and that's perpendicular. A lot of people use these words when they are giving directions. For example, a person could say that the school is at the intersection of Salinas and 11th or that Ceasar Chavez road is parallel with Alamo road.

The Spanish language was used by Miguel to make a connection between home and school. He used the Spanish word "combinar" in a lesson on making combinations. He said combinar means different things that you put together. He also said the word "primo" (cousin) in Spanish could remind the students what a prime number is. He asked his students if you and your primo go shopping, how many people are going shopping. Students replied two. Miguel said that prime numbers have only two factors, one and the number itself. Miguel also said that the word "composite" comes from the Latin word "compuesto." If something is compuesto it is composed of different parts. A composite number has three or more factors.

Uses a wide variety of instructional strategies. According to Gay (2000) culturally responsive teaching is validating in that it uses a wide variety of instructional strategies. The teachers in this study used a wide variety of instructional strategies to teach math to their students. They used: Activating background knowledge; rhymes and sayings; visual aids; activity sheets; journals; real world application; review of previously learned concepts; working in collaborative groups; using the Spanish language; incorporating physical activities; tying new information to previously learned concepts; modeling on the board; textbooks, math programs, and assessments; vocabulary review; and students working independently. These strategies addressed the diverse needs of students and resulted in differentiated instruction even though the teachers did not name differentiated instruction as one of their teaching strategies.

Incorporates culturally mediated cognition. Culturally responsive teaching is comprehensive and it incorporates culturally mediated cognition. The teachers in this study utilized culturally mediated cognition through the use of collaborative groups. Group members shared a common culture. When asked to problem solve together, their common culture facilitated making connections to one another's thinking. Miguel used collaborative groups in a lesson on finding the difference between two squares of unequal size. He had students find the difference between a square that was 10 x 10 and a square that was 7 x 7. He had students first find the area of the smaller square and then find the area of the bigger square then find the difference between the two. He had students work the problem the fifth grade way, which was 10 x10 and subtract 7 x 7, and the middle school way which was $10^2 - 7^2$. Students took about five minutes to complete the activity in their groups. After everyone was finished, Miguel had a student come up to the board and work the problem.

Working in groups of four, Mary had her students generate a multiplication problem for another group in the class to solve. Each group shared one piece of poster paper and wrote out a multiplication problem in sentences. It could not just be numbers. One groups problem was: an animal shelter feeds it's dogs three times a day. They have 98 dogs. How many total feedings do they give in a day? Another groups' problem was: There are four bookshelves in a bookcase. Each shelf has 12 books. How many books are there in all? In another instance where the class was doing problems having to do with possible outcomes, Mary had them work in groups of four to find a solution to a problem concerning shirts and bottoms. The shirts came in four colors: green, yellow, blue, and red. The bottoms were khakis, blue jeans, and shorts. Each group had a piece of chart paper divided into four sections. Each section was used by one student to find the numbers solution, organized list, table, and tree diagram methods of finding the solution. There were a number of times where Mary directed her students to check on their answers with their shoulder or face partner. Other times they were directed to ask questions of their collaborative group members before they asked her.

In a lesson on possible outcomes, Sarah put her students into groups of two or three. She passed out a piece of chart paper to each group. She said they were going to deal with ice cream. They had a cone or a cup, strawberry, chocolate, or vanilla flavors and nuts or sprinkles for toppings. She told them that if they needed help they should go visit their neighbor. She had them rely on each other for help. Sarah walked around the classroom and helped individual groups as needed. In another instance, Sarah had her students work with their partner to create their own bar graph and generate three questions to go along with their graph. Before they made their own graph, Sarah had the students work with a partner to generate questions for a graph they had made as a class. The students drew a colored circle out of a bag. They then made a graph of the colors. Sarah suggested that they make their own graph about their favorite football teams or favorite zoo animals.

Amy likes to have students work in groups so they can help each other. She avers that they are more comfortable asking each other questions than they are asking her. In a lesson on fractions, Amy discussed with her class what one whole would be. One student offered that 4 slices of pizza out of four slices of pizza equal one whole pizza. Amy said that if 22 out of 22 students met their accelerated reading (AR) goal, the whole class met their AR goal. Amy had students work with their shoulder partners to generate a fraction that equaled one whole. In a subsequent lesson on fractions, the class was naming objects that were one half. Amy had her students think of an example of one half in their collaborative groups. In a lesson on telling time, Amy had her students sketch or write anything that came to their mind about telling time. Then she told her students that they were going to talk in their collaborative groups about what they sketched or wrote. She set the timer for four minutes. The timer went off, but she gave them more time to finish talking. Other times, Amy had her students check on their answers to problems with their collaborative group partners before they shared them with the class.

Teaches substantive content. All five teachers in this study taught substantive content. Learning was seen as nonnegotiable, all students were expected to succeed.

Although they believed all students had to play a major role in their own learning; teachers saw their job as creating the necessary structure for students to succeed. One aspect of this structure was to take a no-nonsense approach to learning. This did not mean that teachers did not have fun with students. It meant that teachers expected all students to learn and they were very adept at keeping students focused on the task at hand. In regard to instruction, Amy used elements of an interactive model of teaching/learning (Cummins, 1986, 1989). She encouraged talking and writing as a means to learning. In doing this, she gave students many opportunities to share their own experiences in the classroom. This recognition of the knowledge and experiences students brought into the classroom made learning relevant and meaningful for students. Eva, Mary, Sarah, and Miguel used more of a direct instruction approach to teaching/learning. The teacher modeled problem solving on the board and then gave students opportunity to practice under their guidance.

Miguel in particular taught substantive content to his students. He not only taught them the fifth grade way of doing problems, but also taught them what he called the middle school way. In a lesson on finding the difference between two squares of unequal size, Miguel taught his students to find the answer the fifth grade way which was for example, 10 x 10 minus 7 x 7. The middle school way was $10^2 - 7^2$. Students worked similar problems the same way, both the fifth grade way and the middle school way.

***Builds positive teacher-student relationships*.** Several teachers emphasized strong teacher-student relationships. In observations, it was clear how important the teacher-student relationship was. Students appeared to enjoy interacting with their teachers. Teachers used humor to make students laugh and joined in their laughter. In this environment, learning was seen as fun. One way teachers helped establish these relationships over time was by interacting with students in nonacademic ways. This involved teachers' sharing information about their personal lives and asking questions about students' lives and interests. Establishing relationships with their students helped teachers create a safe environment in which their students could learn. This meant

creating a mental and emotional space that was conducive to learning. Mary shared that she shares her life with students in trying to make connections to them. She said: "I guess I would share where I came from and try to find a connection…so that we can connect. And if not, I can tell them what my life was like and we could find our way toward each other." Mary also pointed out to students when she struggled with something. She would tell her students: "Look, I had to read this more than once to understand it." She allowed students to see her struggle with something and keep at it until she understood it. Teachers also regularly reinforced student's efforts and accomplishments and encouraged students to help each other and recognize each other's accomplishments. In short, these teachers tried to help their students build positive self-esteem.

Sarah builds good relationships with her students through telling them what her life was like as a child. Especially about things they have now that they didn't have then. She tells them that there was a time when she didn't have a hair blow dryer or a microwave. Students are incredulous. She also teaches her students to play the kind of games she played as a child, like hop scotch. Sarah believes that sharing her childhood experiences with her students helps her relate to them. She also tells them that she was not good at math as a child. She hated to do fractions. But now, she says, fractions are fun. She said she always talks to her students about herself. Because Sarah shares her life with her students, they are encouraged to share their lives with her. She stated that she gets to know them pretty good by the stories they tell about themselves. She said: "You just pay attention to them, to what they say, and you learn a lot."

Miguel builds good relationships with his students through giving them compliments. For example he said to one student: "If I had a son I would want him to be just like you." When students volunteer to come to be tutored during Miguel's conference time, he sometimes compliments them in front of the class. He said he wanted them to feel good that they are doing something for themselves. Sometimes students will bring their work to Miguel too be checked and that gives him the opportunity to give them a

compliment such as “great job,” or he will give them a thumbs up, or he will say: “Why do I even need to check your work?” They know that that’s a great compliment.

Culturally responsive teachers. The key concepts of culturally responsive teachers have been advanced primarily by four multicultural education scholars. They are: Gay (2002a), Ladson-Billings (1994), and Villegas and Lucas (2002a). Although these authors’ conceptions of culturally responsive teachers vary to some extent, they also reflect many similarities. Gay advanced five characteristics of *culturally responsive teaching;* Villegas and Lucas (2002a, 2002b) propose six characteristics of *culturally responsive teachers;* and Ladson-Billings (1994) offers 14 characteristics of *culturally responsive teaching.* By integrating characteristics of these three models I arrived at an aggregated set of 10 characteristics that present a more all-inclusive description of culturally responsive teachers. In this aggregated view, the following characteristics of culturally responsive teachers emerged. Culturally responsive teachers:

1. Possess sociocultural consciousness
2. Believe all students can succeed
3. Have the commitment and sills to act as agents of change
4. Embrace the constructivist foundation of culturally responsive teaching
5. Attain knowledge about students and their communities
6. Encourage a community of learners
7. View knowledge critically
8. Use varied assessments that promote learning
9. Engage in cross-cultural communication
10. Endeavor to make classroom instruction culturally congruent

There were instances where the teachers as a group exhibited some of these characteristics of culturally responsive teachers. No one teacher exhibited all the characteristics. Rather, each teacher exhibited one or two of the characteristics. The characteristics observed in this group of teachers were: believing all students can

succeed, attaining knowledge about students and their communities, encouraging a community of learners, and using varied assessments that promote learning.

Mary confirmed that she believes all students can succeed when she told her students that they would eventually "get this." After giving her students a activity sheet on multiplication to do, she told her students: "If you don't get this don't worry you will get it. I will work with you individually until you get it." Also when working with her students on division problems, she told her students: "If you don't understand the first one, it's ok, you will eventually. You're going to get it."

Amy encourages a community of learners by teaching students to respect and value each other. She said that students need to value each other, that "we are a family and it's all built on respect." She shared that it is a struggle but she thinks she has been pretty successful even though it has taken a long time. She said that where she sees how well they respect one another is in the collaborative groups. She notes the tone of voice that they use with each other. She shared that there has been a lot of growth from the first of the year. She said that students will still get defensive with each other but it doesn't happen as much as it did at the beginning of the year.

Sarah attains knowledge about her students and their community by talking about her own life and allowing students to share about theirs. She says: "I talk a lot about my own life. What I have and where I live and my dogs and everything else. Then they share a lot too." She listens for things that she can tie into the traditions of the family. She says: "I pay attention to a lot in my student's lives. I like to learn from them. It's funny sometimes the stories they will tell. But you get to know them pretty good." Sarah averred that students have changed over the years that she has been teaching. She said that currently students are raising themselves. They want so much attention from an adult and she tries to give it to them. She said: "But then you see the hope and you see that they want to come out of it. You just pay attention to them, what they say, and you learn a lot."

Sarah used a variety of assessments to ascertain how well her students comprehended the material. She said she does quick oral assessments frequently. At times she will assess students by having them work on the board. She will also walk around when students are working and if she sees that they are working without any problems, that to her means that they "get it." But because she has to show that she is assessing students, she will give them a written assessment on Fridays. She obtains these written assessments through the curriculum or she will often make them up. She said she usually used only one or two problems, but the students have to show every step in the process.

Eva reported that she does frequent oral assessments. She also uses games and team work to assess students. She said that most of the time they do group activities so students can help each other out but once they do individual work she can readily see who is grasping the concepts and who is not. She assesses students individually every Friday with a paper and pencil test. The paper assessments came from the *Sharon Wells* curriculum.

Making Instruction Comprehensible

Using the Spanish language. Miguel used the Spanish language to make instruction comprehensible to his students. The language served as a bridge from something students understood to new concepts. On one occasion he used the word *primo* to illustrate a concept in prime numbers. He started the lesson by asking his students what prime numbers were. One student offered that "you can multiply it by itself and one." He told the students that this is something related to their own culture. For example in the Spanish language you have something called a *primo.* Miguel said: "If my primo and I are going to the mall how many people are going shopping?" The students replied: "two." Miguel said prime numbers have only two factors. Then Miguel asked the students what the word *compuesto* meant. The students replied that it meant something is composed of different parts. Miguel said, like the word composite, numbers have to have three or more factors. "If a number has 3, 4, 5, or 6 factors is it prime or composite?" The students

replied, “it is composite.” In a lesson on converting feet to inches and inches to feet Miguel asked the students what *cambio* meant in Spanish. Students replied that it means to change. Miguel said that they were going to change feet to inches.

Eva used the Spanish language when she was working with ELL students. Eva said that some of the ELL students were repeatedly unsuccessful until they learned that the teachers could speak Spanish. They would ask the teachers a question in Spanish and the teachers would answer in Spanish then translate into English. The students had questions but didn’t know how to word them in English. The fact that the teachers were bi-lingual really helped. However, the teachers did not instruct the students in Spanish. Spanish was used just to translate vocabulary words. Instruction was all in English.

Mary has eight students in her classroom who are ELL’s. Her instruction however is all in English. She reported that her ELL students speak English very well. Mary encouraged her ELL students to look for cognates or words in Spanish and English that have a common origin. For example in a lesson on median, Mary taught her students that the word median in English is a cognate of the word *medio* in Spanish which means the middle.

Modeling on the board. Eva often used the white board or the smartboard to model how to solve problems. One lesson I observed was on equivalent fractions. Students wrote the definition of equivalent fractions in their journals. They wrote “fractions that have the same value.” Eva reviewed the meaning of the words numerator and denominator. Then she told the students: “there is a very important rule when you dealing with equivalent fractions. That is: what you do to the bottom you do to the top.” She used the example of 1/3 and 2/6. She drew a rectangle on the board and divided it into three equal parts. She drew another rectangle on the board and divided it into six equal parts. She shaded in the equivalent parts in both drawings. She then explained: “In order to get the six on the bottom, I multiplied the three by two. What I do to the bottom I do to the top. So now I multiply the one by two to make 2/6.” She then showed the

students that 2/4 is equivalent to 6/12. She continued with several more examples of equivalent fraction on the board.

Sarah often worked on the board to model new concepts and to review previously learned concepts. After reviewing two *digits* by *one digit* multiplication, Sarah moved on to *three digits* by *one digit* multiplication. She wrote *265 x 7* on the board. She told the students that it was the same process as previously. She went through the steps of working the problem using the vertical model and the area model. Sarah asked students to suggest problems to be solved. One student suggested *836 x 34*. She showed the students how to work the problem using the area model. Sarah indicated that when she is introducing new information to students, she will usually model it on the board for two days. Then students will practice it together for two days, after that they are generally able to work independently. "So it's really a little process. It's a lot of modeling and then it's a lot of togetherness, after that, it's OK, you can do that on your own."

Modeling on the board in a lesson on reviewing rounding, Mary wrote the numbers form one to nine. She asked the students where she should draw the vertical line. Students replied: "between the four and the five." Mary said: "very good. Four or less let it rest, five and up bump it up plus one." The first number the students were to round was 7,634,109. Mary had the students round the number to the nearest hundred thousand's place. Mary modeled the solution by underlining the six and circling the three. She said the number three was the "boss." Mary asked the students what the boss was saying. The students replied that it was saying to let it rest. Mary: "so the six stays the same and the numbers to the right become what?" Students: "zeros." Mary: "what happens to the seven?" Students: "it stays the same."

Miguel frequently introduced new concepts by modeling examples on the board. For example, in a lesson on making combinations, Miguel wrote four words describing types of vases on the board: gold, silver, crystal, and pewter. He said he liked to use A, B, C, and D rather than the object names. He said: "I want to see how many combinations I can make of two. The first combination we can make is A and B, next, A, C; and A, D."

He wrote the combinations on the board. “How many combinations per letter?” Students: “three.” Miguel: How many letters?” Students: “four.” Miguel wrote 3 x 4 = 12 on the board. “You can have 12 combinations.” Miguel said they were going to do a real life situation. They were going to provide the staff with breakfast tacos in the morning. He said each taco had two ingredients. The ingredients were potatoes, egg, chorizo, and bacon. “So, let’s make all the combinations.” Miguel modeled how to make all 12 of the combinations on the board.

Reviewing previously learned concepts. Eva tries to review previously learned concepts whenever possible. She stated that “I think it’s so much information that they are expected to remember and for the amount of concepts we’re teaching if we tie it into previously taught concepts, I think it is more memorable that way.” For example, in a lesson about prediction, she first reviewed what the students had learned about probability. In another instance, Eva reviewed place value with whole numbers as an introduction to a lesson on place value with decimals. She passed out small paper jerseys that had a place value written on them up to the 100 billions place. The students put on their jerseys and arranged themselves in the correct order according to their place value without talking. They did the activity twice to make sure everyone had a chance to participate. She then followed with a lesson on place value with decimals.

At the beginning of each class period that I observed, Sarah reviewed what they had been working on the previous day. During one session, for example, she had students turn to a page in their *Motivational Math* workbook. She asked the class which problems they had difficulty with. Students said “number seven” (the problem was *94x2*). Sarah wrote *94 x 2* on the smart board. She asked the students how many of them preferred to work vertically. Most students raised their hands. Then she asked them how many preferred to work horizontally or the area model. A few raised their hands. Sarah reminded the students that they had to work by steps. First multiply 2 x 4 then multiply 2 x 9. She drew arrows from the two to the four then from the two to the nine. The answer

was 188. Sarah: “ask yourself, did I multiply the top number by the bottom number. If you did then you are done.”

The following is an activity Sarah did with her class to review previously learned concepts about measurements. After reviewing measurements by having students relate measurements to things commonly found in their environment, Sarah had the students do a scavenger hunt in the classroom. She told the students that for the scavenger hunt they were going to do two things. One they were going to work in pairs to find objects and they were going to estimate the length. And two, they were going to find an example of the actual measurement. For an example she held up a notebook.

> She is going to estimate that the notebook measures one foot. Then she is going to find something else that actually measures one foot. So you are going to do two things. You are going to find the estimate, and then you are going to find the actual measurement.

Sarah assigned each group a unit of measurement. She gave some groups the measurements using the U.S. standard whereas others received metric measurements. They had to find three examples of their assigned measurement. Sarah handed out pieces of paper that the students folded in half. On the top half they wrote the word *estimate* and on the bottom half they wrote the word *actual*. They then worked with their partner to find their measurements. Sarah mingled with the groups and asked them questions as they worked. She asked questions such as: “What is the actual length? What did you get? Would that be estimate or would that be actual? What are you finding? Show me what you are measuring.” After the students finished measuring, they presented their findings to the class. The first pair of students who were assigned centimeters shared the tip of a crayon and the metal band around a pencil as their examples of actual measurements. They used the square on a grid paper as an example of an estimate of a centimeter. A second group showed a paper clip and an eraser as an actual inch. The top to a marker was their estimate of an inch.

Mary frequently began the day’s lesson with a review of what they had learned the previous day. At times she would use a activity sheet to review previously learned

concepts, other times she worked on the board or used the students' textbook. On one occasion, as a prelude to a activity sheet, she asked the students questions concerning division that they had learned the previous day. Mary reminded the students that with division they had one total and they were taking out an equal amount. Mary: "And the ones we had left over were called the what?" Students: "the remainder." Mary: "What did we call the inside?" Students: "the dividend." Mary: "yes, and then we have the divisor and the quotient." Mary frequently used activity sheets to reinforce previously learned concepts or to practice recently learned concepts. On one occasion Mary distributed a activity sheet. She used the document reader to work the problems with the students. She worked one or two problems from each page. The first question was: "Martha placed her CD's in the following arrangement. Which number sentence best represents the arrangement of Martha's CD's?" Mary asked the students what they could get out of the word arrangement. They replied that they could get the word array. Using the document reader, Mary worked through each suggested answer while the students identified whether or not that was the answer to the problem.

At the end of a week on learning about fractions, Amy asked her students what they remembered about fractions that they had covered that week. One student offered: "The bigger number goes on the bottom." Another volunteered: "The number on the bottom is called the denominator." Another student offered: "The number on to is called the numerator." One student suggested: "The denominator is the total number." Another put forward that "the numerator is the parts." One student brought up that three out of four students at his table were girls. Amy asked how the boy at that table would be described. Students affirmed: "One out of four students at that table is a boy." Amy responded: "very good. I see a big difference from last Friday to this Friday as to what you have learned about fractions." On one occasion that I observed, Amy used the information the students had recorded in their geometric booklets to review previously learned concepts. The concept was geometric shapes. She said she wanted the students to

take the two minutes before they went to lunch to review the drawings and sketching that they had done in their geometric booklets.

In a lesson reviewing what they had done the previous week in comparing fractions and improper fractions Miguel wrote 5/8 compared to 10/16 on the board. He said that you can multiply 5/8 by 2 and get 10/16 so the fractions are equal. Miguel asked "who can tell me something about improper fractions?" A student volunteered "the top is bigger than the bottom." Miguel: "the first thing you need to remember is that this is more than one. The definition of an improper fraction says that is has to be one or more." Miguel reduced a fraction to 5/4 and asked the students what that would be. The students said they didn't know. He said "I taught you this last week." He finally told them it would be 1 ¼. Miguel: "What would 9/8 be? Students: "1 1/8" Miguel put 6/5 on the board. The students responded that it would be 1 1/5. Miguel next put 8/5 on the board and called on a student to answer. The student said he was not sure. Miguel said 5/5 plus how many more. The student responded 3/5. Miguel put 1 3/5 on the board. In one instance I observed Miguel reviewed the order of operations with the students. He wrote on the board: PEMDAS. He said: "parenthesis first, next exponents, next multiplication, next division, then addition then subtraction."

Correspondence with the culturally responsive pedagogy literature. Using the Spanish language built bridges between student and teachers in this study. Geneva Gay (2000) states that culture is the rule-governing system that defines the forms and content of communication. It is responsible for individual collections of communicative and behavioral meanings. This is so because the communication between adult and child is affected by the forms of exchange and the conditions under which it occurs will affect not only what is said but how involved the child will become. Communication is the main way that humans make meaningful connections with each other and is involved in sharing, teaching, and learning. Language is a way of defining experience, thinking, and knowing. Language is a guide to social reality and to culture. Teachers were able to use students' language to make connections to how students think, know and do. Embedded

within language are cultural values and ways of knowing that strongly influence the way students engage with learning tasks and demonstrate mastery of them. Teachers were able to provide an atmosphere where students were able to convey their intellectual abilities.

English as a second language methods utilized by teachers. Miguel and Mary used cognates to make connections to the language that students were familiar with. For example, Miguel wrote centa on the board. He said:

> *Centa* refers to 100. Centavo comes from the Latin. Spanish comes from the Latin. Cents; it takes 100 cents to make a dollar and a century is 100 years. *Cien* means 100 in Spanish. *Centi* means 1/100. These are your units. Centimeters and meters. One centimeter = 10 millimeters. One meter = 100 centimeters. One meter is about 3 inches more than a yard. *Centi* and *centa* mean something different based on the i and the a. Like niño and niña. Totally different based on the *o* and the *a*. Centa is 100/1 and centi is 1/100. One meter equals 100 centimeters and one millimeter equals $1/10^{th}$ of a centimeter.

Mary also used cognates with the students when she said in a lesson on the median, that the word *medio* means the middle in Spanish.

Eva frequently reviewed new vocabulary that the students were learning. She had students keep their vocabulary words in a journal which they reviewed often. For example in a lesson on division, Eva reviewed the vocabulary that the students had previously been exposed to:

Eva:	Someone give me a vocabulary word that we can relate to the concept of division.
Student:	Quotient.
Eva:	Can you, in your own words, give me the definition of quotient?
Student:	The answer when you divide.
Eva:	Can someone give me another vocabulary word associated with division?
Student:	Divisible.
Eva:	What does the word divisible mean?
Student:	When you divide and have no remainder.

Eva: In the problem 10 ÷ 2 = 5 what are the numbers called?

Student: Five is the quotient, two is the divisor, and 10 is the dividend.

Eva: In your own words, what is a remainder?

Student: The amount left over after division.

All five teachers modeled problem solving on the board. However, Sarah in particular mentioned modeling problems as part of her instructional strategies. She indicated that when she is introducing new information to students, she will usually model it on the board for two days. Then students will practice it together for two days, after that they are generally able to work independently. "So it's really a little process. It's a lot of modeling and then it's a lot of togetherness, after that, it's OK, you can do that on your own."

Teachers used music, rhymes, movement, and visuals when teaching their students. They did not simply rely on verbal input for teaching and learning. For example, Eva often used physical movement, manipulatives, rhymes and sayings, and visual aids in her teaching. Sarah used rhymes and sayings and visual aids. Mary used rhymes and sayings, visual aids, and solving problems on the board. Amy used rhymes and sayings and visual aids. And Miguel used visual aids and solving problems on the board.

Collaborative Groups.

Collaborative groups allow students to share knowledge and to assist one another in learning. It incorporates culturally mediated cognition between group members (Gay, 2000). Collaborative groups are also responsive to Latino/a students more collectivistic value orientation (Ting-Toomey & Chung, 2005).

Amy used some form of collaborative grouping every day that I observed. Sometimes it was simply to check their work with a shoulder partner. Other times it was to do a group project. For example, during a lesson on fractions Amy had her students work with their shoulder partners to produce a fraction that equaled one whole. Later in the same lesson she had students work in their collaborative groups to think of an

example of one-half and to label the part that is the denominator and the part that is the numerator.

Sarah also frequently used collaborative groups. For example, during a lesson on measurement she had the students work in pairs to find objects in the classroom and measure them. She told her students that they were going to do two things. They were going to find objects and estimate the length and then they were going to find additional objects that they actually measured. Each pair of students was given a measurement to work with. Some were given inches, some feet, some yards and some metric units. On another occasion, Sarah had her students work in groups of two or three to find possible outcomes. She said they were going to work with ice cream. The flavors were vanilla, chocolate, and strawberry. They used a cup or a cone and had either nuts or sprinkles for toppings.

During a lesson on possible outcomes Mary had her students work in groups of four to work a problem. The problem had shirts and bottoms of different colors. The shirts were green, yellow, blue, and red. The bottoms were khakis, blue jeans, and shorts. Mary gave each group one sheet of chart paper to work out the problem. Each student in the group worked out a different solution to the problem. For instance, one student worked out the table, another worked out the organized list, another worked out the tree diagram, and another the numbers solution. When working on a activity sheet together, Mary did the first two together with the class. The third problem she directed her students to work with their shoulder partner to work out the problem. In another instance, the class was working on a activity sheet and Mary directed her students to check their answers with their shoulder partners. She said: "If you have a question you can ask your shoulder or your face partner."

Miguel had his students work in groups of four to find the solution to problems having to do with finding the difference between two squares of unequal sizes. He had students work the problems what he called the fifth grade way and the middle school way. For example, one square was 10 x 10 and another was 7 x 7. Miguel showed his

students how to work the problem the fifth grade way by writing on the board (10 x 10) – (7 x 7) = 100 – 49 = 51 square inches. He then showed his students the middle school way of $10^2 - 7^2 = 100 - 49 = 51$ square inches. The students then worked in groups to solve several problems of having two squares of unequal sizes. Some of the problems were $10^2 - 6^2$, $10^2 - 4^2$, and $12^2 - 8^2$.

Correspondence with the culturally responsive pedagogy literature. Geneva Gay (2000) identifies cooperative learning as one of the key pillars of culturally responsive teaching. She adds that the underlying values of human connectedness and collaborative problem solving are high priorities in the cultures of most groups of color in the United States. Cooperation plays a central role in these groups' learning styles. Lucas and Villegas (2002) identify cooperative group work as a means to promote active learning by all students. They state that "when students work in cooperative groups to solve a problem or carry out a project, they share the cognitive demands built into the overall task (p. 93). Glasserfeld (1995) explains that in order to have children have their collective thinking represented, group members must be able to explain their thoughts to each other. In this view, group work is seen as a powerful learning tool because students tend to listen more closely to each other than they do the teacher. Villegas and Lucas (2002) add that culturally responsive teachers create a classroom atmosphere where students converse with the teacher and with each other. Students learn implicitly that concepts are meant to be generated and understood, not simply memorized. This type of instruction conveys to students that they are capable thinkers who can create new ideas. Teachers who create such a classroom community convey to students that they can reach a high level of learning. Such teachers possess an affirming view of all students.

This chapter reviewed the practices of five teachers in teaching mathematics to Latino/a students. Findings revealed that teachers used a wide variety of teaching methods to teach students. They used: Activating background knowledge; rhymes and sayings; visual aids; activity sheets; journals; real world application; review of previously learned concepts; working in collaborative groups; using the Spanish language;

incorporating physical activities; tying new information to previously learned concepts; modeling on the board; textbooks, math programs, and assessments; vocabulary review; and students working independently. Teachers made learning relevant and comprehensible to their students through using some culturally responsive teaching pedagogy. Teachers utilized collaborative groups that helped students make connections to each other's thinking. Teachers also exhibited some of the characteristics of culturally responsive teachers. The characteristics observed in this group of teachers were: believing all students can succeed, attaining knowledge about students and their communities, encouraging a community of learners, and using varied assessments that promote learning.

CHAPTER V

The teacher profiles presented in Chapter IV detailed each participant's personal and professional background experiences as they related to the teacher's work teaching mathematics to Latino students. Teachers' practices concerning math instruction were presented in addition to his or her thoughts about the successes and challenges encountered in their work. The teacher profiles in conjunction with interview and observation data shed light on the three questions that guided this inquiry.

WORKING HYPOTHESIS 1

Lacking preparation in culturally responsive teaching teacher participants addressed the needs of their Latino students incidentally through a wide variety of teaching strategies.

None of the teachers in this study had received training in culturally responsive teaching; many current teacher preparation programs do not offer such preparation. As a result, aspects of culturally responsive teaching were addressed incidentally because participants used a wide variety of teaching strategies. Using a wide variety of instructional strategies is itself a characteristic of culturally responsive teaching. Although these teachers were not aware of the principles of culturally responsive teaching the following characteristics of Gay's (2000) culturally responsive framework were reflected in their instruction: Building bridges between home and school, using a wide variety of instructional strategies, incorporating culturally mediated cognition, building positive student-teacher relationships, teaching substantive content, and showing students they are expected to succeed. The teaching strategies included: using the Spanish language, using physical activity, using students background knowledge, tying new information to previously learned concepts, modeling on the board, using visual aids, using rhymes and sayings, using activity sheets, using journals, using real world application, using lesson plans, textbook, and assessments, reviewing vocabulary, working in collaborative groups, making sense of new information, and working independently.

Perhaps the single most productive practice of most of these teachers was their frequent movement around the classroom to assist individual students. Several purposes were achieved through walking around. The time spent at student's desks provided an opportunity to obtain feedback on the effectiveness of their instruction, kept students on task, offered individual students extra instruction and encouragement and allowed for brief personal interactions between teachers and students. Teachers were able to offer individualized instruction, accomplish informal assessments, engage in teacher reflection, gauge response to intervention, and facilitate classroom management.

WORKING HYPOTHESIS 2

Teachers manifested types 1 and 2 of Cockrell, Placier, Cockrell, and Middleton's typology of teachers' perceptions of culture, social ideology, and school practices.

Hollins (2008) cites Cockrell, Placier, Cockrell, and Middleton (1999) in offering a typology of teachers' perceptions of culture, social ideology, and school practices. According to this typology, for type 1 teachers' culture is defined as that which is observable such as traditional rituals, dress, visual and performing arts, and food. Their ideological stance is likely to be assimilationist in their classroom practices. Type 1 teachers may view learning from a universalistic perspective. When universalistic notions of learning are applied in the classroom, attributions for failing to learn are often placed on the students and tend to locate the problem in the learner. Explanations based on the view that students underachieve based on deprivation, disadvantage, and learning disabilities point to deficiencies in the learner rather than problems with the instructional approach.

Type 2 teachers may view culture as consisting of social and political relationships and world view shared by a group of people. This definition is broader and more abstract than the type one definition. Ideologically, type two teachers subscribe to a multicultural perspective. They promote an egalitarian and pluralistic approach to learning rather than assimilationist. The multicultural perspective is associated with a more inclusive and egalitarian view of all citizens and their cultures. Type 2 teachers want education to be responsive to student diversity. Teachers may believe that students fail because the environment is inflexible. Teachers try to use what works for a student or for a population of students.

Type 3 teachers define culture as affect, behavior, and intellect. Their idea of culture is more abstract and flexible than that of type 1 or 2 teachers. They view culture as playing a more centralized role in society. Type 3 teachers are likely to agree with John Dewey in that school should extend the learning that goes on at home. Type 3 teachers seek to make connections between what the school offers and what students

bring from home. Type 3 teachers encourage and facilitate collaboration among students. Students learn with and from each other. Teachers develop instructional approaches that build on what students learn from their homes and communities. Type 3 teachers view the school curriculum as including knowledge about culture and cultural knowledge. Knowledge about culture includes the beliefs, practices, traditions and accomplishments of a particular group and how society has benefited from the group's experience.

The teachers in this study viewed culture as the beliefs and traditions a person is raised with. It is their background knowledge. This evinces Hollins' type 2 idea of teachers' perceptions of culture. For example, Sarah said her students' culture was "their background, culture, family, heritage, where they came from, what their beliefs are…" Eva said student's culture was "their background, the way they were being raised…it's pretty much their home life…" Amy reiterates that culture is "where you come from, the experiences that you have and the beliefs that you were raised with."

In terms of ideology, teachers held more of an assimilationist ideological stance to classroom practices. They viewed culture as supporting continuity and maintaining the status quo. Their purpose was to preserve the traditions of Western civilization. Miguel acted to preserve the traditions of Western civilization when he said that his students lacked middle class values. According to Miguel, the value most lacking was the work ethic.

Teachers mostly viewed learning from a universalistic perspective. They admitted that their teacher preparation program did not prepare them to work with students' cultures in any significant way. Because of this, teachers tended to place responsibility for failure on the imagined deficits in the students themselves. They attributed student failure to depravation and disadvantage in their home life rather than problems with the instructional approach. At times, however, teachers resisted this perspective when they admitted that there were individual differences in approaches to learning. They were open to trying different approaches to instruction for different learners and they encouraged input and collaboration among students.

These teachers wanted instruction to be responsive to student diversity. They actively sought for methods that would meet the learning needs of individual students who struggled. Sarah said she studies students who struggle to find out what makes them "tick." Mary said she tried different learning methods to find out what helped students. It may have been more manipulatives, a peer tutor, or drawing out the problem that helped individual students.

The teachers in this study engaged in what Hollins (2008) describes as intermittent cultural mediation. In intermittent cultural mediation the teachers and their students share a common culture but find themselves in a situation where the schooling process prevents culturally suitable social situations for learning and knowledge valued by their cultural group. However, in intermittent cultural mediation teachers share understandings with their students and consequently the use of culturally shaped thinking is likely to occur.

The teachers in this study utilized culturally mediated cognition when they facilitated collaborative group learning. Collaborative learning allowed the teachers to employ constructs from the students' culture and backgrounds to facilitate learning. For example, Mary utilized collaborative groups to teach a lesson on multiplication. Students worked in groups to generate their own multiplication problems. Students used familiar items from their backgrounds to write their own problems. Sarah had her students work in collaborative groups in a lesson on possible outcomes. The students generated a chart with their favorite ice cream and toppings.

WORKING HYPOTHESIS 3

Teachers met the needs of a wide variety of students because they were able to strike a balance between direct explicit instruction and collaborative groups.

A discussion of balanced instruction involves comparing the different models or approaches to instruction. In the case of mathematics it generally involves a comparison between behavioral (direct, explicit instruction) and constructivist (collaborative groups)

approaches. Proponents of direct instruction have criticized current state-of-the-art instruction in mathematics for its lack of teacher direction and explicit organization of curriculum content (Jones & Southern, 2003). In a similar vein, constructivists have been critical of direct explicit instruction as being too teacher driven, authoritarian, restricting opportunities for students to learn through authentic experiences, ignoring the social context of learning, and concentrating on lower levels of instruction to the detriment of problem solving skills (Magre & Joshi, 2013).

Direct explicit instruction. Direct instruction is associated with explicit teacher-led instruction. Instruction is delivered in a structured format that includes securing the students attention, prompting student's responses, and allowing for systematic practice. The instructor begins by first gaining the students attention. This can be accomplished by something as simple as saying "class we are going to begin. Please give me your attention." Once the students are attending the teacher reviews what the students have learned already and introduces what the students will be learning in the present session. During the next phase of instruction the teacher models the skill to be learned, assists students in learning the skill, and tests the student's learning. Instruction concludes with an opportunity for review and practice. A basic tenet is to provide much practice for the attainment of skills (Englemann & Carnine, 1991).

Cooperative learning. Cooperative or collaborative learning is important for creating inclusive classroom environments that meet the needs of all students. Most classrooms are heterogeneous and cooperative learning takes this heterogeneity into account. Johnson and Johnson (1994) outlined five key components for effective cooperative learning: positive interdependence, individual accountability, face to face interaction, small group skills, and group processing.

Positive interdependence. It is important for students to perceive themselves as interdependent, sharing a mutual fate which is mutually caused. This creates a "sink or swim" mentality where the success of the group is dependent of the success of all the group members, ensuring a social interdependence in the group. Students come to see

that they are linked with group mates in such a way that they cannot succeed unless their group mates do and they must coordinate their efforts with the efforts of others in their group to complete the task (Johnson & Johnson, 1994

Individual accountability. Slavin (1996) argued that when cooperative learning is poorly constructed it can allow for the "free rider" effect in which some group members do all or most of the work while others do little or nothing. The key to eliminating this is to create individual accountability to ensure that all students and that no members of the group are ignored.

By having group goals and individual accountability students are provided with an incentive to help each other and to encourage each other to put forth maximum effort. Johnson and Johnson (1994) reported that individual accountability can be achieved through the use of individual assessments which are then used to determine the success of the group as a whole

Face to face interaction. The close proximity of small groups encourages students to help, share, and support each other's learning. By working closely together students can promote each other's success through explanations, peer teaching, checking for understanding, discussions, and connecting old and new learning.

Interpersonal and small group skills. Johnson and Johnson (1994) noted that the more socially skilled students were and the more attention teachers paid to rewarding the use of social skills, the higher the achievement was within cooperative learning groups. Teachers should teach students active listening skills, staying on task, questioning skills, and conflict management and resolution skills.

Group processing. Group processing takes place on two levels, in small groups and the whole class. To allow for group processing at the group level, teachers should allow time at the end of each class for groups to process how effectively members worked together. Processing at the class level can be accomplished through having the teacher observe groups, analyze problems, and then provide feedback to the whole class.

The teachers in this study divided their instructional time between cooperative groupings and explicit teacher-led whole-class activity. Previous studies on grouping practices have shown that explicit teacher-led whole-class activity and cooperative learning are both linked to high performance in the classroom (Alghamdi, R., Gillies, R., 2013; Kutnick, Blatchford, Clark, Macintyre, & Baines, 2005; Zahorik, Halbach, & Ehrle, 2003). In explicit teacher-led whole-class activities teachers focus on uniformity of instruction, set single instructional objectives, and deliver core instruction to the whole class. This is often followed by individual assignments. Students are expected to reach the same goals at the same pace, using the same methods and materials. Teacher-directed whole-class instruction is particularly effective when teachers focus on a firm grasp of targeted knowledge, authentic tasks, or challenging problems.

However, explicit teacher-led whole-class instruction poses problems for students who are ELL's and for those who are underachieving (Chang, 2008). When teachers depend mainly on whole-class instruction, students who require special attention may fall behind because individualized instruction for those students becomes difficult. Latino/a students in particular experienced a negative effect from explicit teacher-led whole-class instruction (Chang, 2008). In contrast, in a study by Chang (2008), individual attention by the teacher resulted in gains in the mathematics scores of Latino/a students. When teachers increased the amount of their individual instruction, Latino/a students improved their math ability levels. However, Latino/a ELL students need to be exposed to enough mathematical lessons and language instruction to build their ability to respond favorably to individual guidance from teachers. Cooperative learning provides the necessary language support to benefit ELLs in gaining academic language. Building on Vygotsy's concept of socially negotiated learning, Bicais and Correia (2008) highlighted the linguistically rich environments inherent in classrooms with high language-minority student populations and posited "peer learning spaces" as invaluable resources for developing language and literacy. *Peer-learning spaces*—defined as "learning-oriented talk that children have with each other" (Bicais & Correia, 2008, p. 363)—occur outside

of teacher-initiated discourse patterns and provide educationally valuable opportunities for authentic student interaction. Together, explicit teacher-led whole-class learning and cooperative learning addressed a wide variety of student needs.

WORKING HYPOTHESIS 4

Teachers collaborated among themselves to meet the needs of their students.

Teachers shared students, activity sheets, and assessments among themselves to meet the needs of their students. Sarah said that when she had continuing difficulties with a student, or when the student is not learning well from her instruction, she will switch students with another one of the other fourth grade teachers. She does this because she believes that another teacher may be able to deliver instruction in such a way that the student will learn.

The fourth grade teachers worked as a team to produce activity sheets for their students. When one teacher found a activity sheet that she liked, she would make copies for all the other fourth grade teachers. Most activity sheets were found online or were constructed by one of the teachers.

Weekly assessments were also shared between all the fourth grade teachers. One teacher would find an assessment she liked and would make copies for all the other fourth grade teachers. Assessments were sometimes found online, were taken from one of the students' workbooks, or were constructed by one of the teachers.

Students benefited from teachers producing their own activity sheets and assessments because activity sheets and assessments were closely tied to what they had been doing in the classroom. When teachers produced their own activity sheets and assessments they were able to link them to what students were learning in the curriculum.

WORKING HYPOTHESIS 5

All teachers benefit from training in culturally responsive pedagogy.

In cases where teachers and students are of the same culture it is often believed that teachers do not need training in culturally responsive pedagogy. However, teachers

do need training in order to make primary use of students' cultures in teaching them. Teachers need to be equipped with the necessary tools in order to utilize the rich cultural backgrounds of students. Teachers are unlikely to do this unless they have received training in cultural mediation. This applies to teachers of color teaching CLSD students because teachers need to challenge the mainly European American middle class culture that pervades most schools. Even in cases where teachers of color and students share a common culture, culture clash between students and the school is likely because schools are grounded in the mainly European American middle class culture of the U. S.

LIMITATIONS OF THIS RESEARCH

Little empirical research in education has examined the culturally responsive teaching practices of teachers teaching Latino/a students perceived as being at risk for school failure. This explorative study examined five teachers practices as they taught Latino/s students by examining their beliefs about teaching and observing their practices in their classrooms. Successful teachers were selected in an attempt to contribute to the literature on effective instruction to explore what teachers believe about teaching Latino/a students and how they utilize their students' background experiences.

There were several limitations to this research.

- **Neither parents nor students were included in the teacher participant selection process.**

  Teachers were identified on the basis of their past students passing rates on statewide achievement tests and administrator recommendations. Including parents and/or students in the selection process may have provided a broader representation of stakeholders in the education system. Harry et al. (1996) and Ladson-Billings (1994) found that parents' views about successful teachers may differ from administrators' views.

- **Given that this research examined the practices of five teachers, the transferability of findings is limited.** Findings give insight into these five

teachers' practices in teaching Latino/a students who are perceived to be at risk for school failure. Given the small sample and exploratory nature of the research, caution must be exercised in applying these findings to other teachers and classrooms. In addition, only a unique portion of the country where about 95% of inhabitants are Latino/a was involved. Transferability to other teachers and schools is limited to settings and individuals who most closely resemble those in this study.

- **A limited number of interviews were conducted.**
  I conducted three interviews over a 12-20 week time period from October through February. The interviews were conducted at the beginning, middle, and end of the observations. If I had conducted a debriefing interview after each observation, I may have gathered a more thorough account of teachers' views and reasons for their practices. Although I felt that the number and length of the interviews allowed me to attain the goal I set out to achieve (i.e., allowing me to understand the practices of participating teachers and why they took the actions they did), it is possible that more interviews spread out during the course of the study would have allowed me to gather additional data on teachers' beliefs and practices and might have led to additional or different hypotheses about teachers' practices with their students.
- **English only speaking classrooms were involved in the study.**
  The investigator speaks English only and conducted the research in English only speaking classrooms. It is not known what might have been observed if Spanish-speaking classrooms had been included in the study.

IMPLICATIONS FOR TEACHER PREPARATION PROGRAMS

This research examined successful teachers' practices as they taught mathematics to Latino/a students perceived to be at risk. Findings can give

insight into effective teaching for this population of students. Implications for teacher preparation programs are discussed based on this research.

- **New teachers need preparation to understand how culture influences the teaching/learning process**. The teachers in this study indicated that their teacher preparation programs offered little preparation in working with special groups of students. They concurred that there was effectively no training on how to use students' background knowledge and culture in teaching them. It may be tempting to believe that because teachers and students share a similar culture that special preparation in culturally responsive teaching is not needed. However as this research suggests, teachers still need to know how to utilize students' cultures and background information in order to best meet their educational needs. Such preparation might include elements of a culture-general approach to teaching in which teachers are prepared to take a mindful stance in understanding the broader dimensions of culture along which all cultures vary (e.g. individualism and collectivism [Hofstede, 1997]). Teachers would have a deeper understanding of how culture mediates learning and could harness students' cultures in making learning more accountable to students' background and life experiences. Such preparation may be offered within the framework set forth by Hollins' (2008) *Culture in School Learning* in which she explains the differences between teachers with little to no training in meeting the cultural needs of their students to teachers who have a deep understanding of the process of culturally mediated learning. Another possible framework is offered in the work of Banks & Banks (2007) *Multicultural Education: Issues and Perspectives*. Teachers need to learn how to respect and utilize the cultural strengths of learners. Teachers could be given the opportunity to explore school culture and how it may clash with the cultures of CLSD students. Even

when the teachers and students share a similar cultural background, clashes between the school culture and students' cultures can still occur. This is so because school culture is grounded in dominant middle class European American cultural norms. Unless teachers are taught to resist this influence, culture clashes between schools and students are likely to occur. Teacher preparation in cultural awareness should be taught across all coursework as it is pertinent information for every aspect of teaching.

- **Teachers need preparation in working with students and parents from low income backgrounds.** The teachers in this study held deficit views regarding students and parents from low income backgrounds. It would serve them to have a program that assisted them in questioning their assumptions about people who live in financial poverty conditions. They need to understand their beliefs in this area and how these beliefs affect their teaching of students from low-income backgrounds. Teachers might explore what the concepts of culture and poverty mean to them in relation to how their beliefs and consequent actions impact others.

RECOMMENDATIONS FOR FURTHER RESEARCH

This research adds to the knowledge base on how to best meet the needs of Latino/a students with and without disabilities. Studies that explore the following topics may contribute further to the knowledge base on effective teaching of culturally, linguistically and socioeconomically diverse (CLSD) student populations.

- **Additional studies are needed to expand the empirical knowledge base on successful teaching practices for Latino/a students with and without disabilities to contribute to a database of effective teaching practices with Latino/a students.** Little research exists on culturally responsive teaching with Latino/a students. This research should be replicated for Latino/a students with and without disabilities. Further research should include Latino/a teachers and

teachers from the dominant European American culture, different regions of the country, and school districts where Latino/a students have a different profile of success

- **Studies should explore the culturally responsive teaching practices of teachers of other groups of CLSD students.** It cannot be assumed that ideas about successful teaching will be the same across different groups of students. Research is needed that will take into account the needs of African American, Asian, and Native American students. In addition, collaborative research projects could be conducted where European American teachers and teachers of color could engage in a dialogue about best practices for students of color that would broaden the perspectives of both groups of teachers. This research could focus on culture clashes in the classroom and on ways effective teachers successfully process these interactions to ensure effective communication.
- **Research should be conducted that explores best practices for effectively addressing the multiple diversities that students present.** Little empirical research exists that examines effective teaching of CLSD students with multiple diversity characteristics. One such characteristic includes the low income backgrounds of some students. Other diversity characteristics include gender, ability or disability, generation living in the U. S., and language. Understanding how these diversity characteristics influence classroom interactions with students and the teaching/learning process in general will help teachers address the varied needs of their students.

CONCLUSION

This study examined the teaching strategies of five successful teachers of mathematics in elementary classrooms. In-depth interviews and observations were conducted to explore these teachers' culturally responsive teaching practices. Findings indicated that teachers employed a wide variety of teaching strategies some of which

were culturally responsive practices. Teachers appreciated their students and enjoyed teaching them. Teachers believed poverty was a main determinant of students' underachievement and related poverty to parents' inability to provide much educational support to their children. Teachers believed that this lack of support resulted in students coming to school with a lack of background information that would assist students' success in the classroom.

Teachers appeared to be limited in their understanding of how culture influences the teaching/learning process. They did not appear to be aware of how culture can mediate learning in the classroom. However, teachers' care and commitment to their students appeared to be factors in their ability to respond intuitively to students' cultural characteristics. Although limited in their cultural awareness, teachers' beliefs and practices reflected some of the characteristics of culturally responsive teaching. Teachers validated the backgrounds of many of their students and built bridges between students' home cultures and the school.

Findings of this research contribute to the body of literature on the effective teaching of Latino/a students. Findings indicate that teacher preparation programs need to address cultural diversity for all teachers including teachers with cultural backgrounds similar to their students. Teachers with similar background to their students need to be aware of how student's backgrounds influence the teaching/learning process. In addressing these issues, preparation programs should make teachers aware that understanding how culture influences the teaching/learning process is an ongoing, complex, and dynamic process. Such a process of self-discovery should be seen as positive and necessary in the continuous process of teacher growth.

Appendix A

Questions for teacher interview

1. Tell me about where you grew up.
2. What were your experiences in school?
3. What led you to be a teacher?
4. How long have you been a teacher?
5. What practices do you employ that make learning meaningful for your students?
6. What do you learn from your students that is as important as what they learn from you?
7. Do you expect students to come with a set of prerequisite skills? How do you work with students who do not have the expected prerequisite skills?
8. What do you do to help students think critically rather than just memorize facts?
9. Do you think that knowing the race of historical figures enhances the learning of students of color? Why, in what way?
10. How do you bring the cultural background (race, culture, heritage) of your students into your lesson planning?
11. How do you view the cultural identities of your students? How do you preserve the cultural identity of your students?
12. Respond to the statement: Every child is a unique composite of his or her racial, cultural, home, and peer experiences.
13. How do you view the results of individual assessment? Do you see the results as reflecting the group's efforts toward helping the individual learn as well?
14. Do you see children of color in your classroom or do you just see children? Explain.
15. How do you make connections between what happens in the world and who your students are?

16. How do you view success and failure in your classroom? To what do you attribute student's success or failure?
17. Are there some children in your classroom whom you just cannot seem to connect with? Why or why not?
18. How do you encourage students to work as a team?
19. Do you ask students to work independently more often than you ask them to work together?
20. In general, is it more important for your students to be engaged in independent learning than in peer learning situations? Why?
21. How do children learn?
22. Do all children learn in basically the same way or do they learn differently? Explain.
23. What is your underlying reason for using peer-learning strategies?
24. How often do you see or hear from parents?
25. How do you establish positive home school relations?
26. Do you believe parents should be self-motivated to help their child learn and to be actively involved in the classroom?
27. How much do student responses determine where you go with a lesson?
28. Do you believe that there will be some students who fail no matter what you do? Why?
29. How much do the individual needs of your students come into your lesson planning?
30. How do you adjust your lessons to the proper level for individual students?
31. How important is culturally relevant teaching to you? Explain.
32. How do you identify ways that the school culture (e.g., values, norms, and practices) is different from your student's home culture?
33. How do you view competition between students?
34. What strategies do you implement to minimize the effects of the mismatch between student's home culture and school culture?
35. How do you obtain information about your student's home life?

36. How do you build a sense of trust in your students?
37. How do you assess student learning? Do you use various types of assessments? Explain.
38. How do you help students make sense of new information?
39. How do you identify ways how students may communicate at home differently from school norms?
40. How do you teach students about their culture's contribution to mathematics?
41. How do you use student's native language in the classroom?
42. Have you identified ways that standardized tests may be biased towards culturally diverse students? Explain.
43. How do you help students feel they are important members of the classroom?
44. How do you structure parent teacher conferences so that the meeting is not intimidating for parents?
45. Tell me about a lesson where you showed how other cultural groups have made use of mathematics.
46. Tell me about a time when you used examples that were familiar to students from diverse backgrounds.
47. How do you encourage your students to be responsible for one another?
48. How do you view the learning needs of poor students?
49. How do you view your role as teacher?
50. How do you work with students who are struggling in mathematics?
51. What beliefs do you think are important in working successfully with struggling students?
52. What do you do to develop higher order thinking processes such as hypothesizing, predicting, comparing, evaluating, integrating, and synthesizing?
53. How do you give students an active role in learning?
54. How do you access students' prior knowledge?
55. What is culture?

56. What do you do to assess the learning of bilingual students?

57. What do you think are the most important parts of your student's culture to know?

58. How do you build on student's interests?

59. How do you tap into community resources?

60. Why do you think students of color and poor students tend to perform less well in K-12 schools than their white, middle-class peers?

61. How do you use your knowledge of students?

62. How do you identify "funds of knowledge" that children bring to school?

What do you do to make math make sense to your students?

63. Have you read any books or articles on culturally responsive teaching or Funds of Knowledge? (The Dream Keepers by Ladson-Billings, Culturally Responsive Teaching by Gay, Funds of Knowledge by Moll et al., Educating Culturally Responsive Teachers by Villegas & Lucas, Pedagogy of the Oppressed, by Freire, Culturally Responsive Mathematics Education, by Greer et al.).

REFERENCES

Abedi, J. (2004). The No Child Left Behind Act and English language learners: Assessment and accountability issues. *Educational Researcher, 33*(1), 4-14.

Ahlquist, R. (1991). Position and imposition: Power relations in a multicultural foundations class. *Journal of Negro Education, 60*(2), 158-169.

Ainsworth, J. W. (2002). Why does it take a village? The dedication of neighborhood effects on educational achievement. *Social Forces, 81*(1), 117-152.

Albury, A. (1992). *Social orientations, learning conditions, and learning outcomes among low-income Black and White grade school children.* Unpublished doctoral dissertation, Howard university, Washington, DC.

Allen, B. A., & Boykin, A. W. (1991). The influence of contextual factors on Afro-American and Euro-American children's performance; Effects of movement opportunity and music. *International Journal of Psychology, 26,*(3), 373-387.

Allen, B. A., & Boykin, A. W. (1992). African-American children and the educative process: Alleviating cultural discontinuity through prescriptive pedagogy. *School Psychology Review, 21*(4), 586-598.

Allen, B. A., & Butler, L. (1996). The effects of music and movement opportunity on the analytical reasoning performance of African American and White school children; A preliminary study. *Journal of Black Psychology, 22*(3), 316-328.

Anderson, A. B. (1991). Teaching children: What teachers should know. In M. M. Kennedy (Ed.), *Teaching academic subjects to diverse learners* (pp. 203-117). New York: Teachers College Press.

Apple, M. (1990). *Ideology and curriculum* (2nd ed.). New York: Routledge.

Apple, M. (1996). *Cultural politics and education.* New York: Teachers College Press.

Aronson, J. (2004). The threat of stereotype. *Educational Leadership, 62*(3), 14-19.

Artiles, A. J., Klinger, J. K., Tate, W. F. (2006). Theme issue: Representation of minority students in special education: Complicating traditional explanations. *Educational Researcher, 35*(6), 3-28.

Artiles, A. J., & Mendez, Barletta, (2004).

Artiles, A. J., & Ortiz, A. A. (Eds.). (2002). *English language learners with special education needs.* Washington, D. C: Center for Applied Linguistics.

Artiles, A. J., Rueda, R., Salazar, J. J., & Higareda, I. (2002). Within-group diversity in minority disproportionate representation: English language learners in urban school districts. *Exceptional Children, 71*(3), 283-300.

Artiles, A. J., Trent, S. C., & Kuan, L., (1997). Learning disabilities empirical research on ethnic minority students: An analysis of 22 years of studies published in selected refereed journals. *Learning Disabilities Research & Practice, 12*(2), 82-91.

Artiles, A. J. & Zamora-Duran, G. (1997). Disproportionate representation, A contentious and unresolved predicament. In A. J. Artiles & G. Zamora-Duran (Eds.), *Reducing disproportionate representation of culturally diverse students in special and gifted education* (pp. 1-6). Reston, VA: Council for Exceptional Children.

Arzubiaga, A. E., Artiles, A. J., King, K. A., & Harris-Murri, N. (2008). Beyond research on cultural minorities: Challenges and implications of research as situated cultural practice. *Exceptional Children, 74*(3), 309-327.

Au, K. H. & Jordan, C. (1981). Teaching Hawaiian children: Finding a culturally appropriate solution. In H. T. Trueba, G. P. Guthrie, & K. H. Au (Eds.), *Culture in the bilingual classroom: Studies in classroom ethnography* (pp. 139-152). Rowley MA: Newberry House.

Au, K. H. & Kawakami, A. J. (1994). Cultural congruence in instruction. In E. R. Hollins, J. E. King, & W. C. Hayman (Eds.), *Teaching diverse populations: Formulating a knowledge base* (pp. 5-23). Albany: SUNY Press.

August, D., & Shanahan, T., (2006). *Developing literacy in second-language learners: Report of the National Leteracy Panel on language-minority children and youth.* Mahwah, NJ: Lawrence Erlbaum.

Baca, L. M. & Cervantes, H. M. (2004). *The bilingual special education interface* (4th ed.). Upper Saddle River, NJ: Prentice-Hall.

Bahr, M. W., & Kovaleski, J. F. (2006). The need for problem solving teams. *Remedial and Special Education, 27,* 2-5.

Baidian, N. A. (1983). Dyscalculia and nonverbal disorders of learning. In H. R. Myklebust (Ed.), *Progress* (pp. 235-264). New York: Grune & Stratton.

Baker, S., Gersten, R., & Lee, D. (2002). A synthesis of empirical research on teaching mathematics to low-achieving students. *The Elementary School Journal, 103*(1), 51-73.

Baker, S., Gersten, R., & Scanlon, D. (2002). Procedural facilitators and cognitive strategies: Tools for unraveling the mysteries of comprehension and the writing process and for providing meaningful access to the general curriculum. *Learning Disabilities Research and Practice, 17,* 65-77.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: W. H. Freeman.

Banks, J. (1991). A curriculum for empowerment, action, and change. In C. E. Sleeter (Ed.), *Empowerment through multicultural education* (pp. 125-141). Albany: SUNY Press.

Banks, J. (1993). The canon debate, knowledge construction and multicultural education. *Educational Researcher, 22*(5), 4-14.

Banks, J. (1994). *Multiethnic education: Theory and practice* (3rd ed.). Boston: Allyn and Bacon.

Banks, J. (1995). Multicultural education: Historical development, dimensions, and practice. In J. A. Banks & C. A. M. Banks (Eds.), *Handbook of research on multicultural education* (pp. 3-24). New York: Macmillan.

Banks, J. B., & Banks, C. A. M. (Eds.). (1995). *Handbook of research on multicultural education.* New York: Macmillan.

Barta, J. & Brenner, M. E. (2009). Seeing with many eyes: Connections between anthropology and mathematics. In B. Greer, S. Mukhopadhyay, A. Powell, & S. Nelson-Barber (Eds.), *Culturally responsive mathematics education* (pp. 85-110). New York: Routledge.

Bartolomé, L. (1994). Beyond the methods fetish: Toward a humanizing pedagogy. *Harvard Educational Review, 64*(2), 173-194.

Bennett, C. I. (1999). *Multicultural education: Theory and practice* (4th ed.). Boston, MA: Allyn & Bacon.

Bersoff, D. N. (1981). Testing and the law. *American Psychologist, 36,* 1047-1055.

Betsinger, A. M., García, S. B., Guerra, P. L. (2000). *Research report for the Organizing for Diversity Project.* Austin, TX: Southwest Educational Development Laboratory.

Beyer, L. E., & Liston, D. P. (1996). *Curriculum in Conflict.* New York: Teachers College Press.

Blake, C., Wang, W., Cartledge, G., & Gardner, R. (2000). Middle-school students with serious emotional disturbances (SED) serve as social skill trainers/reinforcers for peers with SED. *Behavioral Disorders, 25,* 280-298.

Blaustein, A. P., & Zangrando, R. L. (Eds.). (1998). *Civil rights and the Black American: A documentary history.* New York: Clarion Books.

Boaler, J., & Greeno, J. G. (2002). Identity, agency, and knowing in mathematics worlds. In Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning.* Westport, CT: Ablex.

Boggs, S. T., Watson-Gegeo, K., & McMillen, G. (1985). *Speaking, relating, and learning: A study of Hawaiian children at home and at school.* Norwood, NJ: Ablex.

Bordieu P., & Passeron, J. (1977). *Reproduction education, society, and culture*. Beverly Hills CA: Sage.

Bowles, S., & Gintis, H. (1976). *Schooling in capitalist America,* New York: Basic Books.

Boykin, A. W. (1982). Task variability and the performance of Black and White school children: Vervistic explorations. *Journal of Black Studies, 12,* 469-485.

Boykin, A. W., & Allen, B. A. (1988). Rhythmic movement facilitated learning in working-class Afro-American children. *Journal of Genetic Psychology, 149,*(3), 335-347.

Boykin, A. W., Tyler, K. M. & Miller, O. (2005). In search of cultural themes and their expressions in the dynamics of classroom life. *Urban Education, 40,* 521-549.

Boykin, A. W., Tyler, K. M., Watkins-Lewis, K., & Kizzie, K. (2006). Culture in the sanctioned classroom practices of elementary school teachers serving low-income African American students. *Journal of Education for Studetns Placed at Risk, 11,* 161-173.

Brantlinger, E., Jimenez, R., Klinger, J., Pugach, M. & Richardson, V. (2005). Qualitative studies in special education. *Exceptional Children, 71*(2), 195-207.

*Brenner, M. E. (1998). Adding cognition to the formula for culturally relevant instruction in mathematics. *Anthropology & Education Quarterly, 29*(2). 214-244.

Brown v. Board of Education, 347 U.S. 483 (1954).

Brown, R. T., Reynolds, C. R., & Whitaker, J. S. (1999). Bias in mental testing since *Bias in Mental Testing. School Psychology Quarterly, 14,* 208-238.

Buck, G. H., Polloway, E. A., Smith-Thomas, A., & Cook, K. W. (2003). Prereferral intervention processes: A survey of state practices. *Exceptional Children, 69,* 349-360.

Butler, F. M., Miller, S. P., Crehan, K., Babbitt, B., & Pierce T. (2003). Fraction instructionforstudentswithmathematicsdifficulties:Comparingtwoteachingsequences. *Journal of Learning Disabilities Research and Practice, 18*(2), 99-111.

Burns, M. K., Vanderwood, M. & Ruby, S. (2005). Evaluating the readiness of prereferral intervention teams for use in a problem-solving model: Review of three levels of research. *School Psychology Quarterly, 20,* 89-105.

Bursuck, W. D., Smith, T., Munk, D., Damer, M., Mehlig, L., & Perry, J. (2004). Evaluating the impact of a prevention-based model of reading on children who are at-risk. *Remedial and Special Education, 25,* 303-313.

Bynoe, P. F. (1998). Rethinking and retooling teacher preparation to prevent perpetual failure for our children. *The Journal of Special Education, 32,* 37-40.

Cabello, B., & Burnstein, N. D. (1995). Examining teachers' beliefs about teaching in culturally diverse classrooms. *Journal of Teacher Education, 46*(4), 285-293.

*Cahnmann, M. S. & Remillard, J. T. (2002). What counts and how: Mathematics teaching in culturally, linguistically, and socio-economically diverse urban settings. *The Urban Review, 34*(3), 179-204.

Calhoon, M. B., & Fuchs, L. S. (2003). The effects of peer-assisted learning strategies and curriculum-based measurement on the mathematics performance of secondary students with disabilities. *Remedial and Special Education, 24,* 235-245.

Campbell, C. P. (1995). *Race, myth, and the news.* Thousand Oaks, CA: Sage.

Campbell, D. T., & Boruch, R. F. (1975). Making the case for randomized assignment to treatments by considering the alternatives: Six ways in which quasi-experimental evaluations in compensatory education tend to underestimate effects. In C. A. Bennett, & A. A. Lumsdaine (Eds.), *Evaluation and experiment: Some critical issues in assessing social programs.* New York: Academic Press.

Cartledge, G., Kea, C. D., & Ida, D. J. (2000). Anticipating differences—celebrating strengths: Providing culturally competent services for students with serious emotional disturbances. *Teaching Exceptional Children, 32*(3), 30-37.

Cartledge, G., & Kourea, L. (2008). Culturally responsive classrooms for culturally diverse students with and at risk for disabilities. *Exceptional Children, 74*(3), 351-371.

Cartledge, G., & Lo, Y. (2006). *Teaching urban learners: Culturally responsive strategies for developing academic and behavioral competence.* Champaign, IL: Research Press.

Cartledge, G., & Loe, S. (2001). Cultural diversity and social skill instruction. *Exceptionality, 9,* 33-46.

Cartledge, G. & Milburn, J. F. (1995). *Teaching social skills to children and youth, Innovative approaches* (3rd ed.). Boston: Allyn & Bacon.

Cartledge, G., & Musti-Rao, (2007).

Cass, M., Cates, D., Smith, M., & Jackson, C. (2003). Effects of manipulative instruction on solving area and perimeter problems by students with learning disabilities. *Learning Disabilities Research and Practice, 18*(2), 112-120.]

Celedon-Pattichis, Sylvia (2004). Alternative secondary mathematics programs for migrant students: Cultural and linguistic considerations. In C. Salinas & M. Franquiz, (Eds.), *Scholars in the field: The challenges of migrant education,* (pp. 197-210). Charleston, WV: ERIC Clearinghouse and Small Schools.

Chrinstenson, S. L., Godber, Y., & Anderson, A. A. (2005). Critical issues facing families and educators. In E. N. Patrikakou, R. P. Weissberg, S. Redding, & H. J. Walberg (Eds.), *School-family partnerships for children's success* (pp. 21-39). New York: Teachers College.

*Civil, M. (2002). Culture and mathematics: A community approach. *Journal of Intercultural Studies, 23*(2), 133-148.

*Civil, M., & Kahn, L. H. (2001). Mathematics instruction developed from a garden theme. *Teaching Children Mathematics, 7*(7), 400-405.

Cochran-Smith, M. (1991). Learning to teach against the grain. *Harvard Educational Review, 61*(3), 279-310.

Cochran-Smith, M. (1997). Knowledge, skills, and experiences for teaching culturally diverse learners: A perspective for practicing teachers. In J. J. Irvine (Ed.), *Critical knowledge for diverse teachers and learners,* (pp. 27-87). Washington, DC: American Association of Colleges for Teacher Education.

Cochran-Smith, M. (1999). Learning to teach for social justice. In G. Griffin (Ed.), *The education of teachers. Ninety-eighth Yearbook of the National Society for the Study of Education* (pp. 27-87). Washington, DC: American Association of Colleges for Teacher Education.

Cochran-Smith, M., Davis, D., & Fries, K. (2004). Multicultural teacher education: Research, practice, and policy. In J. A. Banks, & C. A. M. Banks (Eds.), *Handbook of research on multicultural education* (2nd ed., pp.931-975). San Francisco, CA: Jossey Bass.

Code, L. (1991). *What can she know? Feminist theory and the construction of knowledge.* Ithaca, NY: Cornell University Press.

Cohen, E. G., & Lotan, R. A. (1995). Producing equal-status interaction in the heterogeneous classroom. *American Educational Research Journal, 32*(1), 99-120.

Cole, M. (2000). Struggling with complexity: The handbook of child psychology at the millennium: Essay review of Handbook of Child Psychology by W. Damon. *Human Development, 43,* 369-375.

Cole, N. S. (1981). Bias in testing. *American Psychologist, 36,* 1067-1077.

Corban, J., & Strauss, A. (2008). *Basics of qualitative research.* Thousand Oaks, CA: Sage.

Coyne, M. D., Kame'enui, E. J., & Carnine, D. W. (2007). *Effective teaching strategies that accommodate diverse learners* (3rd ed.). Columbus, OH: Pearson Merrill Prentice Hall.

Craig, S., Hull, K., Haggart, A. G., & Perez-Selles, M. (2000). The influence of sociodemographics and gender on the disproportionate identification of minority

students as having learning disabilities. *Remedial and Special Education, 23,* 49-59.

Crotty, M. (1998). *The foundations of social research.* Thousand Oaks, CA: Sage.

Dalin,, P., & Rust, V. D. (1996). *Towards schooling for the twenty-first century*. New York: Cassell.

Dance, R. A. (1997, May). *Modeling: Changing the mathematics experience in post-secondary classrooms.* Paper presented at the Nature and Role of Algebra in the K-14 Curriculum: A National Symposium, Washington, DC.

Delpit, L. (1988). The silenced dialogue: Power and pedagogy in educating other people's children. *Harvard Educational Review, 58*(3), 280-298.

Delpit, L. D. (1995). *Other people's children: Cultural conflict in the classroom.* New York: New Press.

Demie, F. (2005). Achievement of black Caribbean pupils: Good practiced in Lambeth schools. *British Educational Research Journal, 31,* 481-508.

Deno, S. L. (1992). The nature and development of curriculum-based measurement. *Preventing School Failure, 36*(2), 5-10.

Denton, C. A., Vaughn, S., & Fletcher, J. M. (2003). Bringing research-based practice in reading intervention to scale. *Learning Disabilities Research & Practice, 18,* 201-211.

Diamond, B. J., & Moore, M. A. (1995). *Multicultural literacy: Mirroring the reality of the classroom.* New York: Longman.

Doherty, W., Hilberg, S., Epaloose, G., & Tharp, R. (2002). Standards performance continuum: Development and validation of a measure of effective pedagogy. *The Journal of Educational Research, 96*(2), 78-89.

Donovan, M. S., & Cross, C. T. (Eds.). (2002). *Minority students in special and gifted education.* Washington, DC: National Academies Press.

Drame, E., & Xu, Y. (2008). Examining sociocultural factors in response to intervention models. *Childhood Education, 85*(1), 26-33.

Duda, M. A., & Utley, C. A. (2005). Positive behavioral support for at-risk students: Promoting social competence in at-risk culturally diverse learners in urban schools. *Multiple Voices, 8,* 128-143.

Dudley-Marling, C. & Lucas, K. (2009). Pathologizing the language of poor children. *Language Arts, 86*(5), 362-371.

Duncan, G. J. & Magneson, K. A. (2005). Can family socioeconomic resources account for racial and ethnic test score gaps? *The Future of Children. School Readiness: Closing Racial and Ethnic Gaps, 15*, 35-53.

Dunn, L. M. (1968). Special education for the mentally mildly mentally retarded—is much of it justifiable? *Exceptional Children, 35*(1), 5-22.

Edwards, P. D. (1997). *Barefoot: Escape on the Underground Railroad.* New York: HarperCollins.

Englert, C. S., & Mariage, T. V. (1996). A sociocultural perspective; Teaching ways-of-thinking and ways-of-talking in a literacy community. *Learning Disabilities Research & Practice, 11*(3), 157-167.

*Ensign, J. (2003). Including culturally relevant math in an urban school. *Educational Studies, 34*(4), 414-423.

Erickson, F., & Mohatt, G. (1982). Cultural organization of participation structures in two classrooms of Indian students. In G. Spindler (Ed.), *Doing the ethnography of schooling* (pp. 132-175). New York: Holt, Rinehart & Winston.

Erlandson, D. A., Harris, E. L., Skipper, B. L., & Allen, S. D. (1993). *Doing naturalistic inquiry.* Newbury Park, CA: Sage.

Fantuzzo, J., King, J. A., & Heller, L. R. (1992). Effects of reciprocal peer tutoring on mathematics and school adjustment: A component analysis. *Journal of Educational Psychology, 84,* 331-339.

Farkas, G. (2003). Racial disparities and discrimination in education: What do we know, how do we know it, and what do we need to know? *Teachers College Record, 105,* 1119-1146.

Feiman-Nemser, S., & Melnick, S. (1992). Introducing teaching. In S. Feiman-Nemser & H. Featherstone (Eds.), *Exploring teaching: Reinventing an introductory course* (pp. 1-17). New York: Teachers College Press.

Fletcher, T. V., & Navarrete, L. A. (2003). Learning disabilities or difference: A critical look at issues associated with the misidentification and placement of Hispanic students in special education programs. *Rural Special Education Quarterly, 22*(4), 37-45.

Floden, R. F. (1991). What teachers need to know about learning. In M. Kennedy (Ed.), *Teaching academic subjects to diverse learners* (pp. 181-202). New York: Teachers College Press.

Foorman, B. R. (2001). Critical elements of classroom and small-group instruction promote reading success in all children. *Learning Disabilities Research & Practice, 16*, 203-212.

Ford, D. Y. (1998). The underrepresentation of minority students in gifted education; Problems and promises in recruitment and retention. *The Journal of Special Education, 32,* 4-14.

Ford, D., Grantham, T. C., & Whiting, G. W. (2008). Culturally and linguistically diverse students in gifted education: Recruitment and retention issues. *Exceptional Children, 74*(3), 289-306.

Ford, D. Y., & Harris, j. (1997). A study of the racial identity and achievement of black males and females. *Roper Review, 20,* 105-110.

Foster, M. (1998). It's cooking now: a performance analysis of the speech events of a Black teacher in an urban community college. *Language in Society, 18*(1), 1-29.

Frankenstein, M. (1995). Equity in mathematics education: Class in the world outside the class. In W. G. Secada, E. Fennema, & L. B. Adajian (Eds.), *New directions for equity in mathematics education* (pp. 165-190). Cambridge: Cambridge University Press.

Freedle, R. O. (2003). Correcting the SAT's ethnic and social-class bias: A method for re-estimating SAT scores. *Harvard Educational Review, 73*(1), 1-43.

Freeman, B., & Crawford, l. (2008). Creating a middle school mathematics curricuolum for English language learners. *Remedial and Special Education, 29*(1), 9-19.

Fuchs, D., & Fuchs, L. S. (1986). Test procedure bias: A meta analysis of examiner familiarity effects. *Review of Educational Research, 56,* 243-262.

Fuchs, L. S. & Fuchs, D. (2003). Enhancing the mathematical problem solving of students with mathematics disabilities. In H. L. Swanson, K. R. Harris, & S. E. Graham (Eds.), *Handbook on learning disabilities* (pp. 306-322). New York: Guilford.

Fuchs, L. S. Fuchs, D., Hamlett, C. L. & Stecker, P. M. (1990). The role of skills analysis in curriculum-based measurement in math. *School Psychology Review, 19,* 6-22.

Fuchs, L. S., Fuchs, D., Phillips, N. B., Hamlet, C. L., & Karns, K. (1995). Acquisition and transfer effects of classwide peer-assisted learning strategies in mathematics for students with varying learning histories. *School Pshuycholgy Review, 24,* 604-620.

Fuchs, L. S., Fuchs, D., Yazdian, L., & Powell, S. R. (2002). Enhancing first-grade children's mathematical development with peer-assisted learning strategies. *School Psychology Review, 31,* 569-583.

Fuchs, D., Mock, D., Morgan, P. L., & Young, C. L. (2003). Responsiveness-to-intervention: Definitions, evidence, and implications for the learning disabilities construct. *Learning Disabilities Research & Practice, 18*(3), 157-171.

Furner, J. M., Yahya, N., & Duffy, M. L. (2005). Teach mathematics: Strategies to reach all students. *Intervention in School and Clinic, 41*(1), 16-23.

Garcia, S. B. & Guerra, P. (2004). Deconstructing deficit thinking. *Education and Urban Society, 36*(4), 150-168.

Garcia, S. B., & Ortiz, A. A. (1988, June). *Preventing inappropriate referrals of language minority students to special education.* New Focus Series, No. 5.

Washington, DC: National Clearinghouse for Bilingual Education. Retrieved November 15, 2008, from wsaqhttp://www.ncela.gwu.edu/pubs/classics/focus/05referral.htm

Garcia, S. B., & Ortiz, A. A. (2004). *Preventing disproportionate representation: Culturally and linguistically responsive prereferral intervention.* Denver, CO: National Center for Culturally Responsive Educational Systems (NCRESt). Retrieved November 15, 2008, from http://www.nccrest.org

Garcia, S. B. & Ortiz, A. A. (2006). Preventing disproportionate representation: Culturally and linguistically responsive prereferral interventions. *Teaching Exceptional Children, 38*(4), 64-68.

Garcia, S. B., & Ortiz, A. A. (2008). A framework for culturally and linguistically responsive design of response-to-intervention models. *Multiple Voices, 11*(1), 24-41.

Gardner, R. III, Heward, W. L., & Grossi, T. A. (1994). Effects of response cards on student participation and academic achievement: A systematic replication with inner-city students during whole class science instruction. *Journal of Applied Behavior Analysis, 27,* 63-71.

Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice.* New York: Teachers College Press.

Gay, G. (2002). Culturally responsive teaching in special education for ethnically diverse students: Setting the stage. *Qualitative Studies in Education, 15,* 613-629.

Gay, G. (2009). Preparing culturally responsive mathematics teachers. In B. Greer, S. Mukhopadhay, A. B. Powell, & S. Nelson-Barber (Eds.), *Culturally responsive mathematics education* (pp.189-205). New York, NY: Routledge.

Geertz, C. (1973). Thick description: Toward an interpretive theory of culture. In C. Geertz (Ed.)*, The interpretation of cultures.* New York: Basic Books.

Gerard, B. (1990). Strategies that help learning-disabled students solve verbal mathematical problems. *Preventing School Failure, 31*(1), 24-28

Gerber, M. (2005). Teachers are still the test: limitations of response to intervention strategies for identifying children with learning disabilities. *Journal of Learning Disabilities, 38,* 516-524.

Gersten, R., Baker, S. K., Pugach, M., Scanlon, D., & Chard, D. (2001). Contemporary research on special education teaching. In V. Richardson (Ed.), *Handbook for research on teaching* (4th ed., pp. 695-722). Washington, DC; American Educational Research Association.

Gersten, R., & Carnine, D. (1984). Direct instruction mathematics: A longitudinal evaluation of low-income elementary school students. *The Elementary School Journal, 84*(4), 395-407.

Gersten, R., Chard, D. J., Jayanthi, M., Baker, S. K., Morphy, P., & Flojo, J. (2009). Mathematics instruction for students with learning disabilities: A meta-analysis of instructional components. *Review of Educational Research, 79*(3), 1202-1242.

Giroux, H. (1989). *Teachers as intellectuals.* Granby, MA: Bergin and Garvey.

Glasserfeld, E. von. (1995). *Radical constructivism: A way of knowing and learning.* London: Falmer.

Gold, M. J., Grant, C. A., & Rivlin, H. N. (Eds.). (1977). *In praise of diversity: A resource book on multicultural education.* Washington, DC: Teacher Corps.

Goldsmith, P. A. (2004). Schools' racial mix, students' optimism, and the Black-White and Latino-White achievement gaps. *Sociology of Education, 77*(2), 121-147.

Gonzalez, M. Andrade, R., Civil, M., & Moll, L. C. (2001). Bridging funds of distributed knowledge: Creating zones of practices in mathematics. *Journal of Education for Students Placed at Risk, 6*(1&2), 115-132.

Gonzalez, M., Moll, L. C., & Amanti, C. (2005). *Funds of knowledge: Theorizing practices in households, communities, and classrooms.* Mahwah, NJ: Erlbaum.

Garcia, S. B., & Ortiz, A. A. (2008)

Good, T. L., & Nichols, S. L. (2001). Expectancy effects in the classroom: A special focus on improving the reading performance of minority students in first-grade classrooms. *Educatioanl Psychologist, 36*(2), 113-126.

Gottlieb, J., Gottlieb, B. W., & Trongone, S. (1991). Parent and teacher referrals for a psychoeducational evaluation. *Journal of Special Education, 27,* 453-465.

Grant, C. A. (1997). Critical knowledge, skills, and experiences for the instruction of culturally diverse students: A perspective for the preparation of preservice teachers. In J. J. Irvine (Ed.), *Critical knowledge for diverse teachers and learners* (pp. 1-26). Washington, DC: American Association of Colleges for Teacher Education.

Gravois, T. A., & Rosenfield, S. A. (2006). Impact of instructional consultation teams on the disproportionate referral and placement of minority students in special education. *Remedial and Special Education, 27,*(1), 42-52.

Greenwood, C. R., Hart, B., Walker, D., & Risley, T. (1994). The opportunity to respond and academic performance revisited. A behavioral theory of developmental retardation and its prevention. In R. Gardner, D. M. Sainato, J. O. Cooper, T. E. Heron, W. L. Heward, j. Eshleman, & T. A. Grossi, (Eds.), *Behavior analysis in education: Focus on measurably superior instruction* (pp. 213-223). Pacific Grove, CA: Brooks/Cole.

Greenwood, C. R., Maheady, L., & Delquadri, J. (2002). Classwide peer tutoring programs. In M. Shinn, H. M. Walker, T. G. Stoner (Eds.), *Interventions for academic and behavior problems II: Preventive and remedial approaches* (pp. 611-649). Bethesda, MD: NASP.

Griffin, S. A., Case, R., & Siegler, R. S. (1994). Right start; Providing the central conceptual prerequisites for first formal learning of arithmetic to students at risk for school failure. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 24-49).

Gross-Tsur V., Manor, O., & Shalev, R. S. (1996). Developmental dyscalculia: Prevalence and demographic features. *Developmental Medicine and Child Neurology, 37,* 906-914.

Guba, E. G., & Lincoln, Y. S. (1998). Competing paradigms in qualitative research. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The landscape of qualitative research* (pp. 195-220). Thousand Oaks, CA: Sage.

Guiberson, M. (2009). Hispanic representation in special education: Patterns and implications. *Preventing School Failure, 53*(3), 167-175.

Gutierez, K. (2002). Studying cultural practices in urban learning communities. *Human Development, 45*(4), 312-321.

Gutierrez, R. (2008). A "gap-gazing" fetish in mathematics education? Problematizing research on the achievement gap. *Journal for Research in Mathematics Education, 39*(4), 357-364.

Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy of social justice.* New York: Routledge.

Gutstein, E., Lipman, P., Hernandez, P., & de los Reyes, R. (1997). Culturally relevant mathematics teaching in a Mexican American context. *Journal for Research in Mathematics Education, 28*(6), 709-737.

Haberman,M. (1991, December). The pedagogy of poverty versus good teaching. *Phi Delta Kappan,* 290-294.

Habermas, J. (1971). *Knowledge and human interest.* Boston: Beacon.

Hallahan, D. P., & Mock, D. R. (2003). A brief history of the field of learning disabilities. In H. L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (pp. 16-29). New York: Guilford Press.

Hammond, W. R. (1991). *Dealing with anger: A violence prevention program for African American youth* [Videotape program]. Champaign, IL: Research Press.

Hanley, M. S. (1998). *Learning to fly: Knowledge construction of African American adolescents through drama.* Unpublished doctoral dissertation, University of Washington, Seattle.

Harris-Murri, N., King, K., & Rostenberg, D. (2006). Reducing disproportionate minority representation in special education programs for students with emotional disturbances: Toward a culturally responsive response to intervention model. *Education and Treatment of Children, 29*(4), 779-799.

Harry, B. (1994). *The disproportionate representation of minority students in special education: Theories and recommendations.* Alexandria, VA: National Association of State Directors of Special Education.

Harry, B., & Anderson, M. (1994). The disproportionate placement of African American males in special education programs: A critique of the process. *Journal of Negro Education, 63,* 602-619.

Harry, B., & Klinger, J. (2006). *Why are so many minority students in special education? Understand race and disability in schools.* New York: Teachers College Press.

Harry, B., Klinger, J., Sturges, K. M., & Moore, R. F. (2002). Of rocks and soft places: Using qualitative methods to investigate disproportionality. In D. J. Losen & G. Orfield (Eds.), *Racial inequity in special education* (pp. 71-92). Cambridge, MA: Harvard Education Press.

Heller, K. A., Holtzman, W. H., & Messick, S. (Eds.). (1982). *Placing children in special education; A strategy for equity.* Washington, DC: national Academy Press.

Heward, W. L. (1994). Three "low-tech" strategies for increasing the frequency of active student response during group instruction. In R. Gardner, D. M. Sainato, J. O. Cooper, T. E. Heron, W. L. Heward, J. Eshleman, & T. A. Grossi (Eds.), *Behavior analysis in education; Focus on measurably superior instruction* (pp. 283-320). Pacific Grove, CA: Brooks/Cole.

Heward, W. L. (2003). Ten faulty notions about teaching and learning that hinder the effectiveness of special education. *The Journal of Special Education, 34,* 186-205.

Heward, W. L. (2006). *Exceptional children: An introduction to special education* (8th ed.). Columbus, OH: Merrill/Prentice-Hall.

Hickman, P. (2004). *Socioclutural dimensions of White principal leadership in multicultural schools.* Unpublished doctoral dissertation, The University of Texas at Austin.

Hollins, E. (2008). *Culture in school learning: Revealing the deep meaning* (2nd ed.). New York: Routledge.

Hollins, E. R., King, J. E., & Hayman, W. C. (Eds.). (1994). *Teaching diverse populations: Formulating a knowledge base.* Albany: State University of New York Press.

Horton, S. V., Lovitt, T. C. & Bergerud, D. (1990). The effectiveness of graphic organizers for three classifications of secondary students in content area classes. *Journal of Learning Disabilities, 23*(1), 12-22, 29.

Hosp, J. L., & Reschly, D. J. (2003). Referral rates for intervention and assessment: A meta-analysis of racial differences. *Journal of Special Education, 37,* 67-81.

Huebner, E. S. (1985). The influence of rural, suburban, and urban student background and school setting upon psychoeducational decisions. *School Psychology Review, 14*(2), 239-241.

Hui, (2005).

Individuals with Disabilities Education Improvement Act. (2004). P. L. 108-446, 20 USC 1400, p. 118 Stat. 2647 (2004).

Irvine, J. J. (1990). Black students and school failure: Policies, practices, and prescriptions. New York, NY: Greenwood.

Jensen, A. R. (1980). *Bias in mental testing.* New York: Free Press.

Jordan-Irvine, J. (2003). *Educating teachers for diversity: Seeing with a cultural eye.* New York: Teachers College Press.

Jordan, L., Miller, M. D., & Mercer, C. D. (1999). The effects of concrete to semiconcrete to abstract instruction in the acquisition and retention on fraction concepts and skills. *Learning Disabilities: A Multidisciplinary journal, 9*(3), 115-122.

Kavale, K. (2005). Identifying specific learning disability: Is responsiveness to intervention the answer? *Journal of Learning Disabilities, 38,* 553-562.

Kidder, W. C., & Rosner, J. (2002). How the SAT creates "built-in-headwinds": An educational and legal analysis of disparate impact. *Santa Clara Law Review, 43*(1), 131-211.

King, J. E. (Ed.). (2005). *Black education: A transformative research and action agenda for the new century.* Nahwah, NJ: Lawrence Erlbaum Associates for the American Educational Research Association.

King, J. E., Hollins, E. R., & Hayman, W. C. (Eds.). (1997). *Preparing teachers for cultural diversity.* New York: Teachers College Press.

Klinger, J. K., Artiles, A. J., Kozleski, E., Harry, B., Zion, S., Tate, W. et al. (2005). Addressing the disproportionate representation of culturally and linguistically diverse students in special education through culturally responsive educational systems. *Education Policy Analysis Archives, 13,*(38), 1-39.

Klinger, J. K., Artiles, A. J., & Mendez Barleta, L. (2004). *English language learners and learning disabilities.* Paper presented at the research conference English Language Learners Struggling to Learn; Emergent Research on Linguistic Differences and Learning Disabilities, Scottsdale, AZ.

Klinger, J. K., & Edwards, P. A. (2006). Cultural considerations with response to intervention models. *Reading Research Quarterly,* January/February, 108-117.

Knotek, S. (2003). Bias in problem solving and the social process of student study teams: A qualitative investigation. *The Journal of Special Education, 37,* 2-14.

Kourea, L., Cartledge, G., & Musti-Rao, S. (2007). Improving the reading skills of urban elementary students through total class peer tutoring. *Remedial and Special Education, 28,* 95-107.

Kozol, J. (1991). Savage inequalities: Children in America's schools. New York, NY: Crown

Kozol, J. (2005). *The shame of the nation: The restoration of apartheid schooling in America.* New York: Crown.

Kramer, R. A., Allen, L., & Gergen, P. J. (1995). Health and social characteristics and children's cognitive functioning: Results from a national cohort. *American Journal of Public Health, 85*(3), 312-318.

Krater, J., Zeni, J., & Cason, N. D. (1994). *Mirror images: Teaching writing in black and white.* Portsmouth, NH: Heinemann.

Krezmien, M. P., Leone, P. E., & Achilles, G. M. (2006). Suspension, race, and disability: Analysis of statewide practices and reporting. *Journal of Emotional and Behavioral Disorders, 14,* 217-226.

Kroesbergen, E. H. & Van Luit, J. E. H. (2003). Mathematics interventions for children with special educational needs. *Remedial and Special Education, 24*(2), 97-114.

Ladner, M., & Hammons, C. (2001). Special but unequal: Race and special education. In C. E. Finn, A. J. Rotherham, & C. R. Hokanso (Eds.), *Rethinking special education for a new century* (pp. 85-110). Washington, D. C.: Thomas B. Fordham.

Ladson-Billings, G. (1994). *The dreamkeepers: Successful teaching for African-American students.* San Francisco: Jossey-Bass.

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal,* 32(3), 465-491.

*Ladson-Billings, G. (1997). It doesn't add up: African American students' mathematics achievement. *Journal for Research in Mathematics Education, 28*(6), 697-708.

Ladson-Billings, G. (1998). Just what is critical race theory and what's it doing in a nice field like education? *International Journal of Qualitative Studies in Education, 11*(1), 7-24.

Ladson-Billings, G. (2001). *Crossing over to Canaan: The journey of new teachers in diverse classrooms.* New York:5t65t6 John Wiley.

Lalley, J. P., & Miller, R. H. (2006). Effects of pre-teaching and re-teaching on math achievement and academic self-concept of students with low achievement in math. *Education, 126*(4), 747-755.

Lambert, M. C., Cartledge, G., Lo, Y., & Heward, W. L. (2006). Effects of response cards on disruptive behaviors and academic responding during math lessons by fourth-grade students in an urban school. *Journal of Positive Behavior Interventions, 8,* 88-99.

Lee, C. (1993). *Signifying as a scaffold to literary interpretation: The pedagogical implications of a form of African-American discourse* (NCTE Research Rep. No. 26). Urbana, IL: National Council of Teachers of English.

Lee, O., & Fradd, S. H. (1998). Science for all, including students from non-English-language backgrounds. *Educational Researcher, 27*(4), 12-21.

*Leonard, J., Davis, J. E. & Sidler, J. L. (2005). Cultural relevance and computer-assisted instruction. *Journal of Research in Technology in Education, 37*(3), 263-284.

*Leonard, J., & Guha, S. (2002). Creating cultural relevance in teaching and learning mathematics. *Teaching Children Mathematics, 9*(2), 114-118.

Lerner, J. (2002). *Learning disabilities: Theories, diagnosis, and teaching strategies.* Boston: Houghton Mifflin.

Lesaux, N. K., & Siegel, L. S. (2003). The development of reading in children who speak English as a second language. *Developmemtal Psychology, 39,* 1005-1019.

Lim, J. H. (2008). Double jeopardy: The compounding effects of class and race in school mathematics. *Teaching Children Mathematics, 9*(2), 114-118.

Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic inquiry.* Newbury Park, CA: Sage.

Linan-Thompson, S., Vaughn, S., Prater, K., & Cirino, P. (2006). The response to intervention of English language learners at risk for reading problems. *Journal of Learning Disabilities, 39*(5), 390-398.

Lipka, J. (1994). Culturally negotiated schooling: Toward a Yup'ik mathematics. *Journal of American Indian Education, 33*(3), 14-30.

Lipka, J., & Mohatt, G. V. (1998). *Transforming the culture of schools: Yup'ik Eskimo examples.* Mahwah, NJ: Lawrence Erlbaum.

*Lipka, J., Sharp, N., Adams, B., & Sharp, F. (2007). Creating a third space for authentic biculturalism: Examples from Math in a Cultural Context. *Journal of American Indian Education, 46*(3), 94-115.

Lipka, J., Webster, J. P. Yanez, E. (2005). Introduction. *Journal of American Indian Education. Special Issue, 44*(3), 1-8.

Lipka, J., & Yanez, E. (Eds.). (2005). Introduction: Factors that affect Alaska Native students' mathematical performance. [Special Issue]. *Journal of American Indian Education, 44*(3), 1-8.

Lo, Y., & Cartledge, G. (2006). FBA and BIP: Increasing the behavior adjustment of African American boys in schools. *Behavior Disorders, 31,* 147-161.

Lo, Y., & Cartledge, G. (2007). Office disciplinary referrals in an urban elementary school. *Multicultural Learning and Teaching, 2*, 20-38.

Lo, Y. Y., Loe, S. A. & Cartledge, G. (2002). The effects of social skill instruction on the social behaviors of students at-risk for serious emotional disturbances. *Behavioral Disorders, 27,* 371-385.

Lucas, T. (1997). *Into, through, and beyond secondary school: Critical transitions for immigrant youths.* Washington, DC and McHenry, IL: Center for Applied Linguistics and Delta Systems.

Lyon, G. R., Fletcher, J. M., Shaywitz, S. E., Shaywitz, B. A., Torgesen, j. K., Wood, F. et al. (2001). Rethinking learning disabilities. In C. E. Finn, Jr. A. J. Rotherham, & C. R. Hokanson, Jr. (Eds.), *Rethinking special education for a new century* (pp.

259-287). Washington, DC: Thomas B Fordham Foundation and the Progressive Policy Institute.

Maccini, P., & Gagnon, J. C. (2000). Best practices for teaching mathematics to secondary students with special needs. *Focus on Exceptional Children, 32*(5), 1-22.

Maccini, P., & Gagnon, J. C. (2005). Math graphic organizers for students with disabilities. Retrieved August 31, 2010 from http://k8accesscenter.org/training_resources/documents/MathGraphicOrg.pdf

Maccini, P., & Hughes, C. A. (2000). Effects of a problem-solving strategy on the introductory algebra performance of secondary students with learning disabilities. *Learning Disabilities Research and Practice, 15*(1), 10-21.

MacMillan, D. L., & Reschly, D. J. (1998). Overrepresentation of minority students: The case for greater specificity or reconsideration of the variables examined. *Journal of Special Education, 32,* 15-24.

Malloy, C. E. (1997). Including Afrian American students in the mathematics community. In J. Trentacosta (Ed.), *Multicultural and Gender Equity in the Mathematics Classroom: The Gift of Diversity,* (pp. 23-33). Reston, VA: National Council of Teachers of Mathematics.

Malloy, C. E., & Malloy, W. W. (1998). Issues of culture in mathematics teaching and learning. *The Urban Review, 30*(3), 245-257.

Marston, D. (2002). A functional and intervention-based assessment approach to establishing discrepancy for students with learning disabilities. In R. Bradley, L. Danielson & D. H. Hallahan (Eds.). *Identification of learning disabilities: Research to practice* (pp. 437-447). Mahwah, NJ: Erlbaum.

Martson, D., Muyskens, P., Lau, M., & Canter, A. (2003). Problem-solving model for decision making with high-incidence disabilities: The Minneapolis experience. *Learning Disabilities Research & Practice, 18*(3), 187-200.

*Matthews, L. E. (2003). Babies overboard! The complexities of incorporating culturally relevant teaching into mathematics instruction. *Educational Studies in Mathematics, 53*, 61-82

McCardle, P., Mele-McCarthy, J., Cutting, L., Leos, K., & D'Emilio, T. (2005). Learning disabilities in English language learners: Identifying the issues. *Learning Disabilities Research & Practice, 20*(1), 1-5.

McCray, A. D., & Garcia, S. B. (2002). The stories we must tell: Developing a research agenda for multicultural and bilingual special education. *International Journal of Qualitative Studies in Education, 15*(6), 599-612.

McDermott, R. Goldman, S., & Varenne, H. (2006). The cultural work of learning disabilities. *Educational Researcher, 35*(6), 12-17.

McGrath, D. J. & Kuriloff, P. J. (1999). They're going to tear the doors off this place: Upper-middle-class parents' school involvement and the educational opportunities of other peoples' children. *Educational Policy, 13,* 603-629.

McLloyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist, 53,* 185-204.

Mehan, H. (1992). Understanding inequity in schools: The contribution of interpretive studies. *Sociology of Education, 65,* 1-20.

Mellard, D. (2004). *Understanding responsiveness to intervention in learning disabilities determination.* Retrieved July 1, 2005, from www.nrcld.org/html/information

Mellard, D. F., Byrd, S. E., Johnson, E., Tollefson, J. M., & Goesche, L. (2004). Foundations and research on identifying model responsiveness to intervention sites. *Learning Disabilities Quarterly, 27,* 243-356.

Mercer, M. (1973). *Labeling the mentally retarded.* Berkeley: University of California Press.

Meyer, G., & Patton, J. M. (2001). On the nexus of race, disability, and overrepresentation: What do we know? Where do we go? On Point…brief.

Newton, MA: National Institute for Urban School Improvement. (ERIC Document Reproduction Service No. ED4622487).

Middleton, M., & Cartledge, G. (1995). The effects of social skills instruction and parental involvement on the aggressive behaviors of African American males. *Behavior Modification, 19,* 192-210.

Mills v. Board of Education of the District of Columbia, 384 F: Supp.866 (1972).

Mohatt, G., & Erickson, F. (1981). Cultural differences in teaching styles in an Odwa school: A sociolinguistic approach. In H. Trueba, G. Guthrie, & K. Au (Eds.), *Culture and the bilingual classroom: Studies in classroom ethnography,* (pp.105-119). Cambridge, MA: Newbury House.

Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into Practice, 31*(2), 132-142.

Moll, L. C., & Gonzalez, N. (1997). Teachers as social scientists: Learning about culture from household research. In P. M. Hall (Ed.), *Race, ethnicity and multiculturalism: Policy and* Practice (pp. 89-114). New York: Garland.

Montgomery, W. (2001). Creating culturally responsive, inclusive classrooms. *Teaching Exceptional Children, 33*(4), 4-9.

Moore, R., Cartledge, G., & Heckman, K. (1995). The effects of social skill instruction and self-monitoring on anger-control, reactions-to-losing, and reactions-to-winning behaviors of ninth-grade students with emotional and behavioral disorders. *Behavioral Disorders, 20,* 253-266.

Morrison, K. A., Robbins, H. H., & Rose, D. G. (2008). Operationalizing culturally relevant pedagogy: A synthesis of classroom-based research. *Equity & Excellence in Education, 41*(4), 433-452.

Moschkovich J., & Nelson-Barber, S. (2009). What mathematics teachers need to know about culture and language. In B. Greer, S. Mkhopadhyay, A. B. Powell, & S.

Nelson-Barber (Eds.), *Culturally responsive mathematics education* (pp. 111-136). New York: Routledge.

Moses, R. P., & Cobb, Jr., C. E. (2001). *Radical equations: Math literacy and civil rights.* Boston: Beacon Press

Mujis, D. & Reynolds, D. (2000). School effectiveness and teacher effectiveness in mathematics: Some preliminary findings from the evaluation of the Mathematics Enhancement Programme (Primary). *School Effectiveness and School Improvement, 11*(3), 273-303.

National Center for Education Statistics (2009). *Tables and Figures.* Retrieved May 13, 2010 from: nces.gov/pubs2010/20100151/tables/table_11_2.asp

National Collaborative on Diversity in the Teaching Force, 2004. *Assessment of diversity in America's teaching force: A call to action.* Washington, DC: National Collaborative on Diversity in the Teaching Force.

National Council of Teachers of Mathematics (1991). *Principles and standards for school mathematics* Retrieved January 18 from http://www.nctm.org/profile/default.aspx

National Research Council (2001). *Adding it up: Helping children learn mathematics.* J. Kilpatrick, J. Swafford and B. Findell (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, D. C.: National Academy Press.

Neal, L. I., Davis McCray, A., & Webb-Johnson, G. (2001). Teachers' reactions to African American students' movement styles. *Intervention in School and Clinic, 36,* 168-174.

Nieto, S. (1996). *Affirming diversity: The sociopolitical context of education.* White Plains, NY: Longman.

Nieto, S. (1999). *The light in their eyes: Creating multicultural learning communities.* New York: Teachers College Press.

Nieto, S. (2000). *Affirming diversity: The sociopolitical context of multicultural education* (3rd ed.). New York: Addison Wesley.

No Child Left Behind Act of 2001. (2002). P. L. 107-110.

Oaks, J. (1982). The reproduction of inequity: The content of secondary school tracking. *The Urban Review, 14,* 107-120.

Oaks, J., & Lipton, M. (1994). Tracking and ability grouping: A structural barrier to access and achievement. In J. Goodlad & P. Keating (Eds.), *Access to knowledge: The continuing agenda for our nation's schools* (pp. 187-204). New York: College Board.

Oaks, J., Joseph, R., & Muir, K. (2004). Access and achievement in mathematics and science: Inequalities that endure and change. In J. A. Banks & C. A. Banks (Eds.), *Handbook on research in multicultueal education* (2nd ed.). San Francisco, CA: Jossey-Bass

Obiakor, F. E., & Utley, C. (1996). *Rethinking preservice and inservice training programs for teachers in the learning disabilities field: Workable multicultural models.* (ERIC Document Reproduction Service, ED397594).

Ochoa, S. H., Robles-Pina, R., Garcia, S. B., & Breunig, N. (1999). School psychologists' perspectives on referrals of language minority students. *Multiple Voices, 3*(1), 1-13.

Ortiz, A. A. & Wilkinson, C. Y., Robertson-Courtney, P., & Kushner, M. I. (2006). Considerations in implementing intervention assistance teams to support English language learners. *Remedial and Special Education, 27*(1), 53-63.

Ortiz, A. & Yates, J. (2002). Considerations in the assessment of English language learners referred to special education. In A. Artiles, & A. Ortiz (Eds.), *English language learners with special education needs: Identification, assessment and instruction* (pp. 65-86). McHenry, IL: Center for Applied Linguistics and Delta Systems.

Pai, Y. (1990). *Cultural foundations of education.* New York: Merrill/Macmillan.

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1*(2), 117-175.

Pang, V. O., & Sablan, V. A. (1998). Teacher efficacy: How do teachers feel about their abilities to teach African American students? In M. E. Dilworth (Ed.), *Being responsive to cultural difference* (pp. 39-58). Thousand Oaks, CA: Corwin.

Patton, J. M. (1998). The disproportionate representation of African Americans in special education: Looking behind the curtain for understanding and solutions. *The Journal of Special Education, 32,* 25-31.

Patton, M. Q. (2002). *Qualitative research and evaluation methods.* Thousand Oaks, CA: Sage.

Peske, H. G., & Haycock, K. (2006). *Teaching inequity: How poor and minority students are shortchanged on teacher quality.* Washington, DC: Education Trust.

Pew Hispanic Center (2008). One in five and growing fast: A profile of Hispanic public school students. Retrieved on March 31, 2010 from http://pewhispanic.org/topics/?TopicID=4

Phillips, S. U. (1982). *The invisible culture: Communication in classroom and community on the Warm Sorinas Indian reservation.* New York: Longman Press.

Piaget, J. (1977). *The development of thought: Equilibrium of cognitive structures.* Translated by A. Rosin. New York: Viking.

Plessy v. Ferguson, 163 U.S. 537 (1896).

Pollock, M. (Ed.). (2008). *Everyday antiracism: Getting real about race in school.* New York, The New Press.

Poon-McBrayer, K. F., & Garcia, S. B. (2000). Profiles of Asian American students with LD at initial referral, assessment, and placement in special education. *Journal of Learning Disabilities, 33,* 61-71.

Porter, R. E., & Samovar, L. A. (1991). Basic principles of intercultural communication. In L. A. Samovar & R. E. Porter (Eds.), *Intercultural communication: A reader* (6th ed., pp. 5-22). Belmont, CA: Wadsworth.

Pugach, M. C. (2001). The stories we choose to tell: Fulfilling the promise of qualitative research for special education. *Exceptional Children, 67*(4), 439-453.

Pysh, M. V. D., & Chalfant, J. C. (1992). *Teacher assistance teams: In Educational approaches and program options for integrating students with disabilities: A decision tool* (pp. 4.287-4.314). Research Triangle Park, NC: Research Triangle Institute.

Rappaport, D. (2000). *Freedom river.* New York: Hyperion.

Rasanen, P., & Ahonen, T. (1995). Arithmetic disabilities with and without reading difficulties: A comparison of arithmetic errors. *Developmental Neuropsychology, 11,* 274-295.

Reich, R. B. (1999). "Forward." In R. B. Freeman, *The new inequality: Creating solutions for poor America* (7-13). Boston: Beacon.

+

Rist, R. (1970). Student social class and teacher expectations: The self-fulfilling prophecy in ghetto education. *Harvard Educational Review, 40*(3), 411-451.

Robinson, D., Schofield, J., & Steers-Wentzell, K. (2005). Peer and cross-age tutoring in math; Outcomes and their design implications *Educational Psychology Review, 17,* 327-362.

Robertson, P., Kushner, M. I. Starks, J., Drescher C. (1994). An update of participation rates of culturally and linguistically diverse students in special education. *The Bilingual Special Education Perspective, 14,* 1-9.

Romberg, T. (1992). Problematic features of the school mathematics curriculum. In P. W. Jackson (Ed.), *Handbook of research on curriculum* (pp. 749-788). New York: Macmillan.

Rothstein-Fisch, C., Trumbull, E., Isaac, A. Daley, C., & Perez, A. I. (2003).

Rury, J. L. (2002). *Education and social change: Themes in the history of American schooling.* Mahwah, NJ: Lawrence Erlbaum.

Salend, S. J. (2005). *Creating inclusive classrooms: Effective and reflective practices* (5th ed.). Columbus, OH: Merrill/Prentice Hall.

Salend, S. J., & Garrick Duhaney, L. M. (2005). Understanding and addressing the disproportionate representation of students of color in special education. *Intervention in School and Clinic, 40*(4), 213-221.

Salend, S. J., Garrick Duhaney, L. M., & Montgomery, W. (2002). A comprehensive approach to identifying and addressing issues of disproportionate representation. *Remedial and Special Education, 23,* 289-299.

.Salend, S. J., & Taylor, L. S. (2002). Cultural perspectives: Missing pieces in the functional assessment process. *Intervention in School and Clinic, 38*, 104-112.

Saracho, O. N. (2003). Literacy-related play of kindergarten Spanish-speaking students. *Journal of Hispanic Higher Education, 2*(4), 358-376.

Saracho, O. N. (2003a). Matching teachers' and students' cognitive styles. *Early Childhood Development and Care, 17*(3), 161-173.

Saravia-Shore M., & Arvizu S. F. (1992). *Cross-cultural literacy: Ethnographies of communication in multiethnic classrooms.* New York: Garland.

Scanlon, D., Deshler, D. D. & Schumaker, J. B. (1996). Can a strategy be taught and learned in secondary inclusive classrooms? *Learning Disabilities Research & Practice, 11*(1), 41-57.

Schroder, A. (1996). *Minty: The story of Harriet Tubman.* New York: Dial.

Schultz, E. L., Neyhart, K., & Reck, U. M. (1996). Swimming against the tide: A study of prospective teachers' attitudes regarding cultural diversity and urban teaching. *Western Journal of Black Studies, 20,* 1-7.

Scruggs, T. E., & Mastropieri, M. A. (1998). Tutoring and students with special needs. In K. Topping & S. Ehly (Eds.), *Peer-assisted learning* (pp. 165-182). New York: Lawrence Erlbaum.

Serwatka, T. S., Deering, S., & Grant, P. (1995). Disproportionate representation of African Americans in emotionally handicapped classes. *Journal of Black Studies, 25,* 492-506.

Shade, B. J. (1998). *Common sense about common knowledge: The knowledge bases for diversity.* Washington, DC: American Association of Colleges for Teacher Education.

Sheets, R. H. (2005). *Diversity pedagogy: Examining the role of culture in the teaching-learning process.* Boston: Pearson/Allyn & Bacon.

Shepard, L. A. (1987). The case for bias in tests of achievement and scholastic aptitude. In S. Modgil & C. Modgil (Eds.), *Arthur Jensen: Consensus and controversy* (pp. 177-190). New York: Falmer Press

Simmons, D. C. & Kame'enui, E. J. (2003). *Scott Foresman Early Reading Intervention.* Glenview, IL: Scott Foresman. Retrieved November 5, 2007, from http://www.scottforesman.com/eri/index.cfm

Siwatu, K. O. (2007). Preservice teachers' culturally responsive teaching self-efficacy and outcome expectancy beliefs. *Teaching and Teacher Education, 23*(7), 1086-1101.

Skiba, R. J., Michael, R. S. Nardo, A. C., & Peterson, R. (2002). The color of discipline: Sources of racial and gender disproportionality in school punishment. *The Urban Review, 34,*9(4), 317-342.

Skiba, R. J., Poloni-Staudinger, L., Gallini, S., Simmons, A. B. & Feggins-Azziz, R. (2006). Disparate access; The disproportionality of African American students with disabilities across educational environments. *Exceptional Children, 72,* 411-424.

Skiba, R. J., Poloni-Staudinger, L., Simmons, A. B., Feggins-Azziz, R., & Chung, C. G. (2005). Unproven links: Can poverty explain ethnic disproportionality in special education? *The Journal of Special Education, 39,* 130-144.

Skiba, R. J., Simmons, A. B., Ritter, S., Gibb, A. C., Rausch, M., Cuadrado, J., et al. (2008). Achieving equity in special education: History, status, and current challenges. *Expectional Children, 74,* 264-288.

Slavin, R. E. (1995). Cooperative learning and intergroup relations. In J. A. Banks & C. A. M. Banks (Eds.), *Handbook of research on multicultural education* (pp. 628-634). New York: Macmillan.

Slavin, R. E., & Madden, N. A. (1989). What works for students at risk: A research synthesis. *Educational Leadership, 46*(5), 4-13.

Sleeter, C. E. (2001). Epistemological diversity in research on preservice teacher preparation for historically underserved children. *Review of Research in Education, 25,* 209-250.

Smedley, A. (2007). *Race in North America: Origin and evolution of a worldview* (3rd ed.). Boulder, CO: Westview Press.

Smith, G. P. (1998). *Common sense about common knowledge: The knowledge bases for diversity.* Washington, DC: American Association of Colleges for Teacher Education.

Spring, J. (1995). *The intersection of cultures: Multicultural education in the United States.* New York: McGraw-Hill.

Stake, R. E. (1995). *The art of case study research.* Thousand Oaks, CA: Sage Publications Inc.

Steele, C. M. (2003). Through the back door to theory. *Psychological Inquiry, 14,* 314-317.

Steele, C. M. & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African-Americans. *Journal of Personality and Social Psychology, 69,* 797-811.

Strutchens, M. E., & Silver, E. A. (2000). NAEP findings regarding race/ethnicity: Students' performance, school experiences, and attitudes and beliefs. In E. A. Silver & P. A. Kennedy (Eds.), *Results from the seventh mathematics assessment*

of the National Assessment of Educational Progress (pp. 45-72). Reston, VA: National Council of Teachers of Mathematics.

Sturges, & Moore, (2002).

Sugai, G., & Horner, R. H. (2005). School wide positive behavior supports: Achieving and sustaining effective learning environments for all students. In W. L. Heward, T. E. Heron, N. A. Neef, S. M. Peterson, D. M. Sainato, G. Y. Cartledge, R. Gardner, L. D. Peterson, S. T. Hersh, & J. C. Dardig, (Eds.), *Focus on behavior analysis in education: Achievements, challenges, and opportunities* (pp. 90-102). Upper Saddle River, NJ: Prentice Hall/Merrill.

Swanson, H. L., & Hoskyn, M. (1998). Experimental intervention research on students with learning disabilities: A meta-analysis of treatment outcomes. *Review of Educational Research,* 68, 277-321.

Takaki, R. (1993). *A different mirror: A history of multicultural America.* Boston: Little Brown.

Tate, W. F. (1995). Returning to the root: A culturally relevant approach to mathematics pedagogy. *Theory into Practice, 34*(3), 166-173.

Thompson, A. (1992). Teachers' beliefs and conceptions: A synthesis of the research. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 127-146). New York: Macmillan.

Torgesen, J. K. (2002). The prevention of reading difficulties. *Journal of School Psychology, 40*(1), 7-26.

Townsend, B. L. (2000). The disproportionate discipline of African American learners: Reducing school suspensions and expulsions. *Exceptional Children, 66,* 381-391.

Trent, S. C., & Artiles, A. J. (1998). Multicultural teacher education in special and bilingual education: Exploring multiple measurement strategies to assess teacher learning. *Remedial and Special Education, 19*(1), 2-6.

Trumbull, E., Rothstein-Fisch, C., Greenfiled, P. M., & Quiroz, B. (2001). *Bridging cultures between home and school: A guide for new teachers.* Mahwah, NJ: Erlbaum.

Valencia, R. R. (1997). Race-ethnicity and measured intelligence: Educational implications. *American Psychologist, 52*(10), 1103-1114.

Valencia, R. R., & Suzuki, L. A. (2000). *Intelligence testing and minority students: Foundations, performance factors, and assessment issues.* Thousand Oaks, CA: Sage.

Valenzuela, A. (1999). *Subtractive schooling: U. S. Mexican youth and the politics of caring. New York:* State University of New York.

Verdugo, R. R. (2002). Race-ethnicity, social class, and zero-tolerance policies. *Education and Urban Society, 35,* 50-75.

Villegas, A. M. (1991). *Culturally responsive teaching for the 1990s and beyond.* Washington, DC: American Association of Colleges for Teacher Education.

Villegas, A. M. (1998). *Equity and excellence in education.* Princeton, NJ: Educational Testing Service.

Villegas, A. M., & Lucas, T. (2002). *Educating culturally responsive teachers: A coherent approach.* New York: State University of New York Press.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. In M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.). Cambridge, MA: Harvard University Press

Wade, R. C. (1997). Community service-learning: An overview. In R. C. Wade (Ed.), *Community service learning: A guide to including services in the public school curriculum,* (pp. 19-34). Albany: SUNY Press.

Weiner, L. (2006). *Urban teaching: The essentials.* New York: Teachers College Press.

Weinstein, C. S., Tomlinson-Clarke, S., & Curran, M. (2004). Toward a conception of culturally responsive classroom management. *Journal of Teacher Education, 55,* 25-38.

Webb, J., Wilson, B., Corbett, D., & Mordecai, R. (1993). Understanding caring in context: Negotiating borders and barriers. *Urban Review, 25*(1), 25-45.

What Works Clearing House. (2009). *Assisting students struggling with mathematics: Response to intervention for elementary and middle schools.* Retrieved January 17, 2010, from http://www.ies.ed.gov/ncee/wwc/pdf/practiceguides/rti-_math_pg_042109.pdf-2009-04-09

Wilkinson, C. Y., Ortiz, A. A., Robertson, P. M., Kushner, M. I. (2006). English language learners with reading-related LD. *Journal of Learning Disabilities, 39*(2), 129-141.

Witzel, B. S. (2005). Using CRA to teach algebra to students with math difficulties in inclusive settings. *Learning Disabilities: A contemporary Journal, 3*(2), 53-64.

Witzel, B., Mercer, C. D., & Miller, M. D. (2003). Teaching algebra to students with learning difficulties; An investigation of an explicit instruction model. *Learning Disabilities Research and Practice, 18,* 121-131.

Yin, R. K. (2003). *Case study research design and methods* (3rd ed.). Thousand Oaks, CA: Sage Publications Inc.